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RUN

The Commodore 64 & VIC-20 Magazine

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July 1984
A CWC/I Publication

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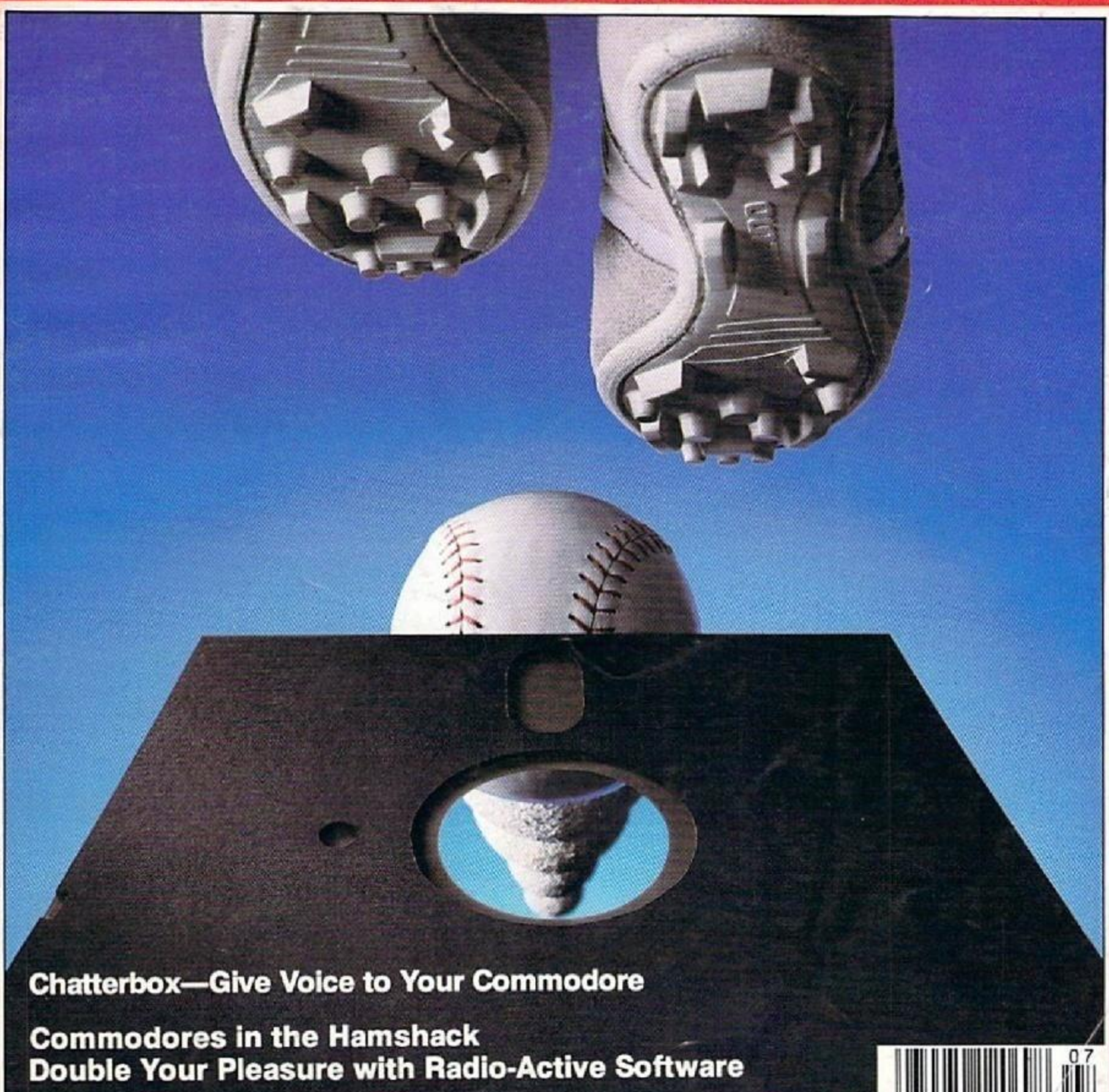

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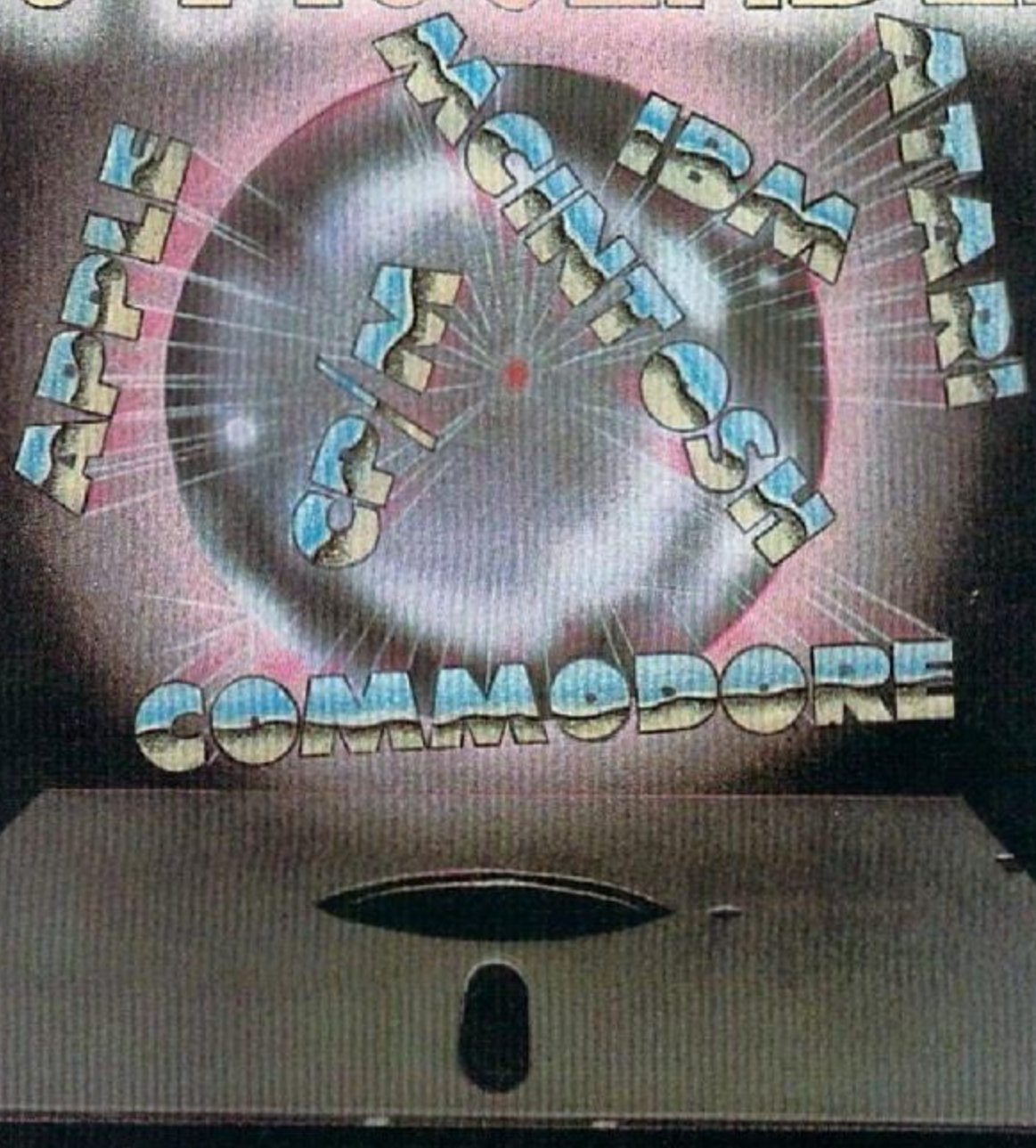

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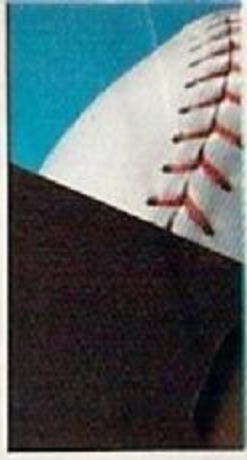

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July 1984
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For all you softball nuts, here's a program that will help you keep track of your stats...easily, accurately and neatly. Lead the league with your C-64. *By Paul Howe*

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58 Morse Code Medley

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With this program, you can custom-make your own sprites and view them from all angles and in all possible sizes. *By M.J. Clifford*

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Follow these directions for interfacing synthesizer ICs, and you'll have your computer talking back to you loud and clear. *By Cass R. Lewart*

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In this challenging all-graphics game for the unexpanded VIC-20, you're the commander of a mothership in space and must rescue 18 astronauts who'll soon be gasping for air. *By Ken Gardner*

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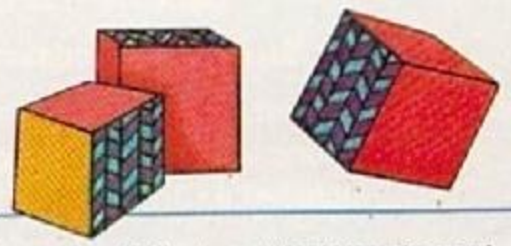

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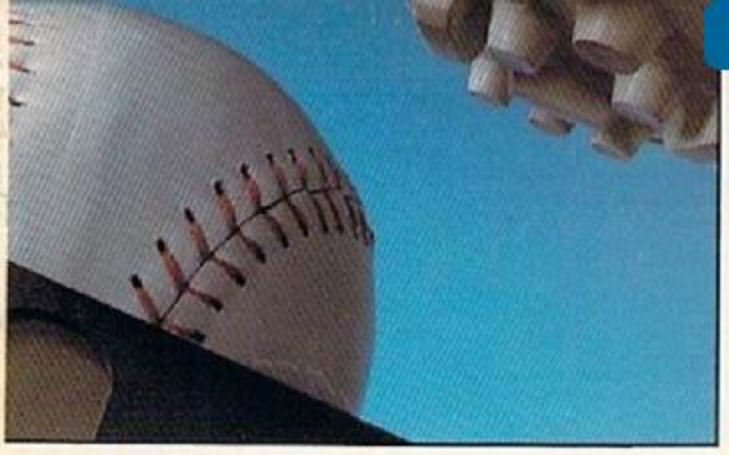

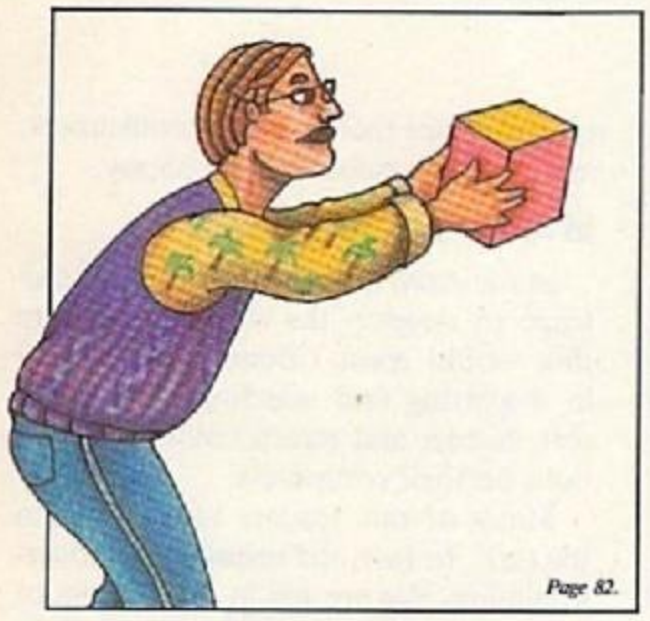

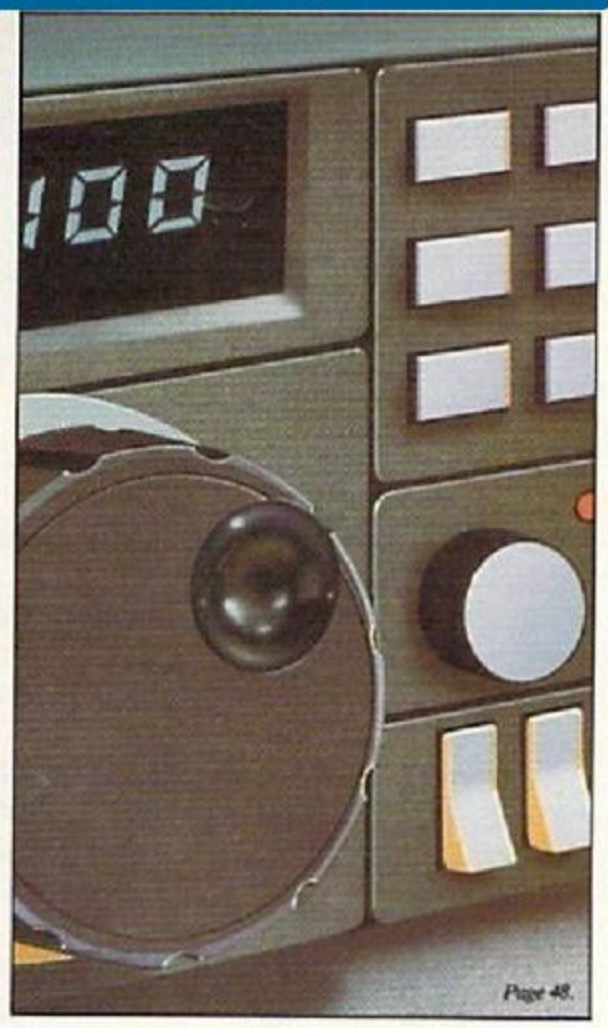

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Cover photo by Martin Paul.
Designed by Suzanne Torsheya.

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RUNning Ruminations

The Blue-Collar Microcomputer

How would you like to be a Commodore stockholder right now?

Figures for the third quarter fiscal year indicate that Commodore International's sales, earnings and income continue to set records, thanks largely to the popularity of the Commodore 64. According to chairman of the board, Irving Gould, "Commodore recorded excellent microcomputer systems sales gains, especially of its Commodore 64 personal computer."

While quarterly earnings statements and comments can sometimes be misleading, Commodore's record is nonetheless impressive in light of the recent upheaval experienced at the executive level, reported delays in new product releases and reevaluation of the company's marketing strategy. Media pundits were quick to forecast hard times ahead for the company.

It seems that when you're number one, people love to knock you off your perch. But each time Commodore has landed on its feet.

Commodore may lack the pizazz of Apple and the prestige of IBM, but hasn't Commodore given these companies a run for their money in the microcomputer field?

Now Commodore has introduced another home computer. In a burst of originality, this one is being called the Commodore 16 (with, of course, 16K). It is being billed as the replacement for the VIC-20, and will sell for around $100.

With this announcement, it appears that Commodore will retain its position as price leader in the marketplace. It is this commitment to giving consumers the best possible computer at the lowest possible price that keeps the consumers, as well as the stockholders, happy.

In Answer to a Challenge

In the April issue we presented a challenge to develop the shortest program that would assist Commodore owners in displaying and selecting all possible text, border and screen color combinations on their computers.

Many of our readers were equal to the task. In fact, the response was overwhelming. We are still in the process of sifting through the hundreds of solutions sent in by our readers. Next month we will share with you some of the best and most interesting programs submitted.

Many readers have suggested that we continue to present challenges in subsequent issues. That's fine with us, but to do so, we need your input.

Share with us *your* thoughts on what programming challenges we should issue. They should test our readers' programming abilities to solve a problem or devise a useful program. The winners do not necessarily have to be the shortest programs, either.

Send your ideas for appropriate challenges to:
RUN
Programming Challenge
80 Pine St.
Peterborough, NH 03458

Attention, Manufacturers

In an upcoming issue slated toward the end of the year, *RUN* will be publishing a list of manufacturers and their products that support the Commodore 64 and VIC-20 systems.

In order to make this list as comprehensive as possible, we will be sending out questionnaires to all Commodore manufacturers. We ask your assistance in filling out these questionnaires and returning them as soon as possible.

If you are a manufacturer and do not receive a questionnaire by the end of July, please let us know so that you may be included. Thanks.

How to type listings from RUN Magazine

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from RUN by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.
{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.
{SHIFT CLR}—hold down the shift key and press the CLR/HOME key.
{HOME}—press the CLR/HOME key without shifting.
{CTRL 6}—hold down the control key and press the 6 key.
{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).
{CRSR UP} {CRSR DN} {CRSR LF} {CRSR RT}—these are the four cursor directions.
{UP ARROW}—means the arrow key (the one with the pi sign under it).
{LB.}—the British pound sign (£).
{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

We hope this system will make it easier to enter the listings without having to remember or refer to any charts or conventions. If you have any suggestions as to how we might improve the system to make it even easier, drop us a letter.

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Commodore Clinic

By Jim Strasma

Commodore Clinic is a monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your VIC-20 or C-64 computer. Send questions along with a business-sized SASE to:*

Jim Strasma
Commodore Clinic
1238 Richland Ave.
Lincoln, IL 62656

So this column can help as many people as possible, please try to limit your questions to topics of general interest, and limit each letter to one question. This column is somewhat like a free medical clinic—the price is right, but the lines are long. Including a stamped self-addressed reply envelope will cut your wait, but I can only give full answers to questions that will appear in the Clinic.

Updates: Reader Jeff Collins reports those interested in programs that teach German on the C-64 can contact Micro Learningware, Box 307, Mankato, MN for his German Packages I, II and III.

Similarly, those looking for a bulletin board system for the C-64 that's less expensive than the Punter BB system, mentioned last month, may want to contact reader Robert Shannon. He offers a system for $25 that you can test by calling him at 709-964-7114.

Q: How can I save the C-64 Wedge program on the disks I use?

Jack Cope
Newport, TN

A: To do this easily, you either need a friend with a dual disk drive, or a machine-language monitor, such as Supermon on Commodore's Disk Bonus Pack or Micromon (included with the MAE assembler from Eastern House Software).

With a dual disk, simply put your new formatted disk in drive 1, the disk Commodore packed with your 1541 in drive 0 and type the following command:

```
OPEN1,8,15
PRINT#15,"C1:*=0:BOOT WEDGE"
PRINT#15,"C1:*=0: C-64 WEDGE"
```

(Remember to substitute the filenames used on your disk, if they differ.)

With a single drive, load a machine-language monitor. Then load the Boot Wedge program and save it to your new disk. Next, load the C-64 Wedge itself, remembering to add ",1" to the Load command, so it won't load to the wrong address. Finally, execute an SYS statement to the monitor and save the machine language part of the Wedge with the following command:

```
.S"0: C-64 WEDGE",08,CC00,CF59
```

Repeat this sequence for each disk you wish to contain the Wedge.

Q: Six weeks ago I sent in the business reply card to get in touch with advertisers, 60 of them. I have only received seven replies. Where are the rest?

Jeff Bentley
Memphis, TN

A: Although it takes a while for that card to get back to *RUN* and be typed into an address list for forwarding to advertisers, it's safe to assume the seven companies you heard from first are better organized to handle customer support than those you'll hear from months later, if at all.

In defense of the companies, *RUN*'s growth has been faster than projected, and some small companies are overwhelmed at the number of people who request information via bingo cards. Even so, I limit my own shopping to companies that respond promptly and helpfully to my inquiries.

Software

Q: I would like to be able to copy a very large relative file for backup and so I can give copies to other people. I only have a single 1541 disk drive connected to a C-64. If necessary, I can borrow another drive. Is there some way I can copy this information without it taking a very long time? I'm *desperate* over this. People are asking for this file already.

Chuck Peavey
Salt Lake City, UT

A: Perhaps this doesn't apply to you, but your comments remind me of the situation many companies get into when they advertise a product for sale before the product works. It seems to me that the loss of sales of a newly available product because of a time lag in the ads is far less harmful to a company than becoming notorious for advertising products that don't yet exist.

Now, to copy a relative file, I recommend borrowing that other 1541 and doing the copy with Jim Butterfield's Copy All program, found on Commodore's bonus disk, and in most user group libraries. You'll also have to change one of the two disk drives to be device 9 temporarily, as described in the disk manual.

You may not consider the process fast, but it will be as fast as is easily possible using 1541s. Higher speed could be gained by using a 4040 disk drive or an MSD dual drive, and the Copy command in DOS. If you're in business, a dual drive is a good investment. It should save both time and effort in backing up important data daily.

Q: When drawing in bit-mapped graphics, is there a way to change the color of only one horizontal line, without changing the color of the horizontal

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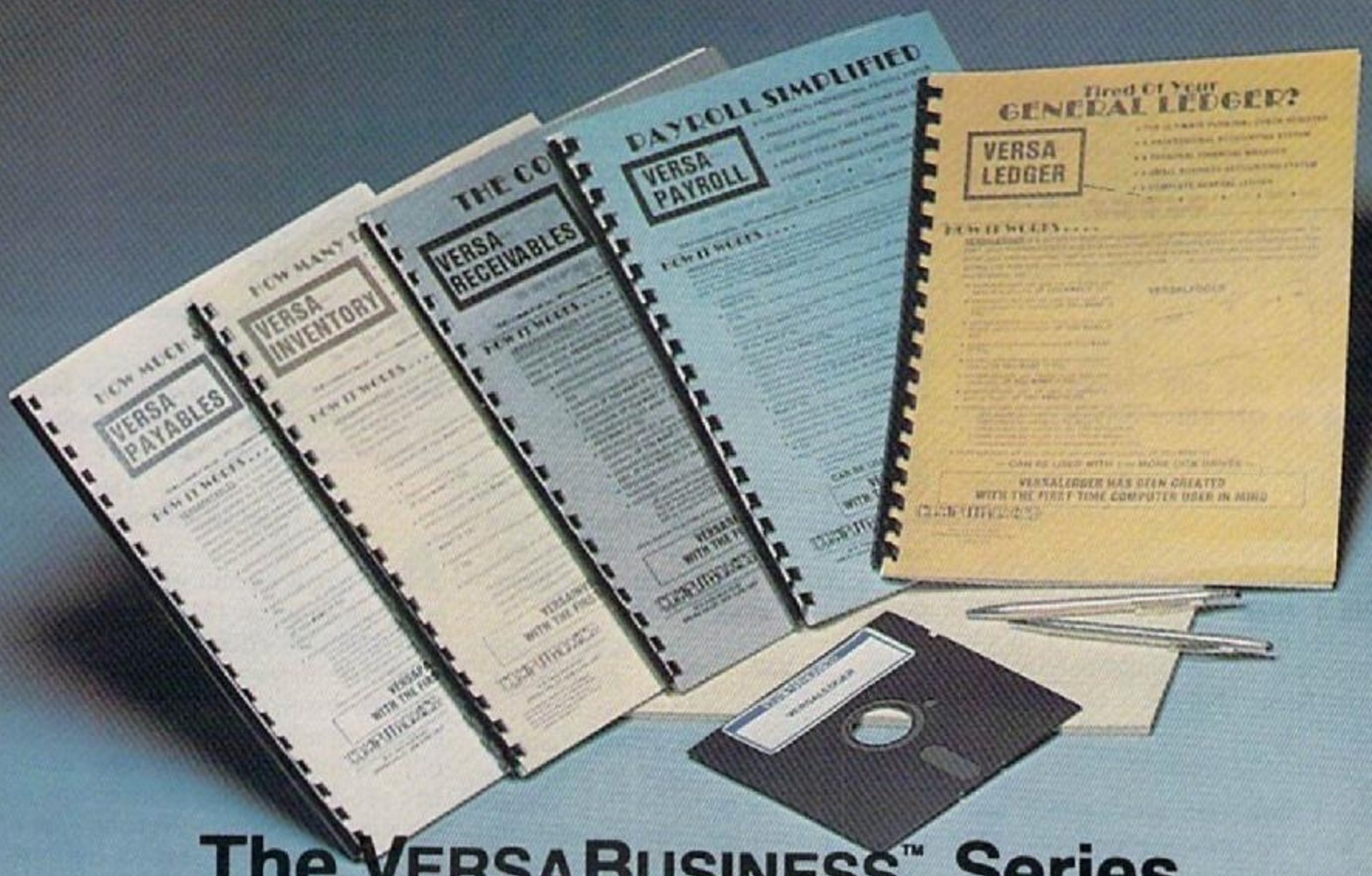

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lines directly above and below the line? That is, is there a way to change the color of just one pixel instead of an area the size of the cursor?

Bill Akler
Cheney, KS

A: Not easily. However, the illusion of doing so can be achieved by careful selection of foreground and background colors for each character position. This is done very well and understandably in the Pen Palette program I use with the Flexidraw light pen (both from Inkwell Systems, San Diego, CA).

Q: If a disk with Fortran is available for the 64, where may it be purchased?

Dave Henning
Victoria, TX

A: Nevada Fortran by Ellis Computing is available for C-64s equipped with Commodore's CP/M card. It's a Commodore product, and may be ordered from full-line Commodore dealers.

Q: I have been looking high and low for a software package that will turn my 64 into a DEC VT100 smart terminal. Do you know anyone who will sell a program that will allow full screen 80-column by 24-line editing without side-scrolling?

Dan Lockhart
Richmond, KY

A: Until your last three words, you were asking for Superterm, from Midwest Micro Associates. However, it uses side-scrolling instead of the software 80-column technique (which is surprising, since they pioneered that technique). On the plus side, it has full VT100 emulation and numerous other features.

Q: I would like to program my 64 with a list of telephone numbers. It would auto-dial them, speak a programmed message when the party answered and enable the party to leave their name and number so I could contact them later. If the party hung up, the computer would go on to the next number. If the party did not answer, the number would be restored and dialed again later. Can this be done using my 64? Can you improve on my idea?

John Baustian
Nampa, ID

A: Yes, it can be done, but if you ever call me with it, I guarantee I'll hang up immediately, and swear never to buy your product even if you're giving away thousand dollar gold bars for free. This is one of the worst ideas I've heard of in a long time, but unfortunately, you aren't the only one to suggest it.

If you are proceeding anyway, you'll need an automodem, a telephone answering machine, a hardware hacker and a programmer to link them together.

Q: We have been informed by our junior high curriculum committee that we should teach, in sequence, Logo, maybe Karel, Pascal and then Basic. What do you think?

K.W. Hardie
Eureka, CA

A: In my opinion, Pascal is almost dead except for school use, in spite of its adoption for use in the SAT's advanced placement tests for college-bound students. Its creator no longer uses it, sales of UCSD Pascal, the best-known version, have nosedived during the past year, and having its operating system written in Pascal appears to be one primary reason Apple's Lisa I failed in the marketplace.

According to a recent issue of the *DTACK Grounded* newsletter, back when USC taught beginning computer students in Basic, almost everyone passed. But now that Pascal is used instead, over 50% fail the course.

I suggest your curriculum committee needs to rethink their infatuation with Pascal. If they want good structure, along with the ease of use offered by Basic, COMAL would probably be a far better choice. It's available in versions for 64, CBM and PET users (not available for the VIC and B series computers) for $20 from The COMAL User's Group, 5501 Groveland Terrace, Madison, WI.

As for the others, Karel is an aid to learning Pascal, and isn't needed unless you'll be using Pascal. Logo, on the other hand, is a fine way for kids to learn programming. COMAL's turtle graphics commands are identical to those in Logo, allowing those who know Logo to step up to COMAL painlessly.

Personally, of the languages you mentioned, I teach only Basic, using a highly structured approach, and find it entirely adequate for students, from my son who's in second grade to college sophomores.

(No letter bombs, please; the reader asked for an opinion. Pascal fans are invited to express contrary opinions.)

Hardware

Q: Could you tell me if it makes any difference if you use single- or double-density disks, and why?

Tim Marzilli
South Portland, ME

A: No, it doesn't make any difference, because the 1541 (like the 4040, 2031 and 1540 drives before it) has the same data density as other single-density disk drives, even though it has more overall capacity. It achieves this sleight-of-hand by varying the number of sectors per track, adding more sectors per track as you approach the outer edge of the disk and have more room for them.

A double-density disk is identical to a single-density disk, except that it has been tested differently. Both are certified to work on the drives for which they were designed. Given the choice between getting double-density disks instead of single-density, or getting a better brand of disks instead of a lesser one, go for the premium single-density disks every time. On the other hand, if you have some double-density disks around, feel free to use them—they'll work fine on the 1541.

Q: What is the PEdisk II mentioned on p. 88 of the February *RUN:* and how can you get one?

Russ Warnky
Wichita, KS

A: The PEdisk is a very fast disk drive that is usable with Commodore's computers, but is neither read- nor write-compatible with Commodore's own disk drives. I have one for my

(continued on p. 118)

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Compiled by Louis F. Sander

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Since July is the month for Canadian and U.S. national holidays, we've collected some real "firecrackers" for your amusement. So tear yourself away from the festivities, switch on your computer and try our monthly *obeah*.

If you've missed one or more of our columns, or if you're hungry for more and better tricks than we have room for in these pages, take heart! We're planning a whole *book* of magic, categorized, indexed and cross-indexed for easy use. And if our readers keep submitting good tricks at their current rate, it could be a *very* thick volume, indeed. We'll keep you posted on its progress.

Trick writers take note: *Please* submit only one trick per sheet of 8½-×11-inch paper, double-spaced from your printer if possible, with your name and address at the top of the page. Also notice our new box number this month—very computer-like, isn't it?

Well, enough of this idle chatter. Let the Magic begin...

$8C Clarification of reset buttons trick—Trick $33, printed back in April, showed several ways to attach a reset button. A Reset command stops program execution, returns all internal pointers to their power-up values, and brings the Bytes Free message to the screen. It has the same effect as turning the computer off, then back on, except that memory is not erased. The resetting of the pointers makes it *seem* as though Basic programs are erased, but they are still there, where an UNNEW program can revive them. Judging from our mail, many readers don't know about UNNEW programs.

The Basic program listed below creates a machine language UNNEW program that resurrects Basic programs after a Reset or a New command. As printed, it works with disk drive; if you want a tape version, change the 8 in the last part of line 60 to a 1.

To add UNNEW to your bag of tricks, enter and run our program. If you've made a critical typing mistake, you'll get an error message. If you don't get one, delete lines 1-3, then save the remaining lines as UNNEW BASIC. Run the program again, and it will automatically make and save a machine language program named UNNEW525. (It will also erase itself—we *told* you to save it!) When you need to use the UNNEW program, enter LOAD"UNNEW525",N, 1 (where n = 8 for disk or 1 for tape). When the load is finished, enter SYS525:CLR and your Basic program will reappear.

L.F.S

```
10 REM - UNNEW MAKER - RUN'S MAGIC, 7/84
20 FORI=1TO53:READX:CS=CS+X:NEXT
30 IFCS=6918THENPRINT"OK-DELETE LINES 20-40":END
40 PRINT"ERROR IN DATA STATEMENTS":STOP
50 FORA=525TO577:READD:POKEA,D:NEXT
60 POKE43,13:POKE44,2:POKE45,66:POKE46,2:CLR:SAVE"UNNEW
   525",8,1:NEW
70 DATA 160,3,200,177,43,208,251,200
80 DATA 200,152,160,0,145,43,165,44
90 DATA 200,145,43,133,60,160,0,132
100 DATA 59,162,0,200,208,2,230,60
110 DATA 177,59,208,245,232,224,3,208
120 DATA 242,200,208,2,230,60,132,45
130 DATA 164,60,132,46,96
```

Listing. Creates a machine language UNNEW program, as described in trick $8C.

$8D Debugging hint—When searching for the cause of a Syntax error, press the Commodore and shift keys to change the screen display to lowercase. This makes numbers and letters easy to distinguish, and you can spot a zero from an O, a one from an L or an omitted number quite easily.

Marion Maddocks
Glenwood, IA

$8E Debugging tip—When your program stops due to an error, or when it runs but gives unexpected results, it's often useful to examine the values of the variables in the program. You can easily look at them from Direct mode, just by entering PRINT A to look at A, PRINT X$ to look at X$ and so on.

You can even look at arrays by typing in a simple Direct mode For...Next loop. But be careful—certain actions will reset all your variables to null. The most common of these are CLR, Run, or making additions, deletions or changes to numbered lines. As long as you avoid taking these actions before looking at the variables, this technique can save you many hours of frustration.

James P. Koermer
Papillion, NE

$8F Eagle—This works on any Commodore computer, including the oldest PETs. Use the color keys and the cursor keys. If you have a VIC, use 200 instead of 150 in the For...Next loop.

```
1 GETK$:PRINT"[3 CRSR LF][3 spaces][3 CRSR LF]"K$MID$
  ("[SHFT U][SHFT W][SHFT I][SHFT J][SHFT W][SHFT K]",
  X+1,3):X=3-X:FORD=1TO150:NEXT:GOTO1
```

Carl Onsgard
Green Bay, WI

$90 VIC screen scraper.

```
1 FORG=5TO55:POKE36864,G:POKE36865,G+G:FORF=
  1TO65: NEXTF,G:POKE36864,5:POKE36865,25
```

Ramey Bell
Fall City, WA

$91 Design with sound—VIC one-liner:

```
10 PRINTCHR$(204.5+RND(1));:X=INT(RND(1)*120)+135:POKE
   36878,15:POKE36875,X:GOTO10
```

Chris Blair
Staten Island, NY

$92 Dynamic design—VIC one-liner:

```
1 POKE 36879,PEEK(36879)AND247:PRINT
  "[CLR]":FORI=1TO99:POKE RND(1)*506+
  38400,RND(1)*10:NEXT
```

I. Firkusny
New York, NY

$93 Amazing one-liner—Here is one of the best one-liners I have ever seen. It works on the VIC and C-64, drawing a continuous maze that is very interesting.

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```
8 PRINT CHR$(205.5+RND(8)); : GOTO 8
```

To get random colors on the C-64, add CHR$(149+RND(8)*11) just before the semicolon.

Dan A. Krueger
Cary, IL

$94 Input magic—If you don't want the question mark with an Input statement, try entering POKE 19,64 before it. This disables the question mark. To recover, enter POKE 19,0.

With this technique, you can't just press the return key where an input is required—the cursor will not move until you actually input something. Also, the cursor does *not* automatically move to the next line following your press of the return key; if you want it down there, just execute a Print statement following the input.

Bart van Baren
Wageningen, Netherlands

$95 Input improved—One drawback of the Input statement is that it prompts the user with a question mark even if the instruction is not a question. You can avoid this by using the Input# statement and having the computer treat the keyboard as a peripheral. Here's an example:

```
10 PRINT "TYPE YOUR NAME ";
20 OPEN1,0:INPUT#1,NM$:PRINT:CLOSE1
30 PRINT NM$
```

With this method, the computer doesn't print a carriage return after the inputted data, so you must add PRINT after INPUT#, as is done in the example. If your program does a lot of inputting, you could set up the material in line 20 as a subroutine to be called each time you need it.

Randy Palermo
Fort Jones, CA

$96 Input hint—If you use Input statements, you should know that the computer reads everything to the right of the question mark. So if you have graphics or text to the right of an Input statement on the same line, the computer will read it along with your data, most likely causing an error.

The solution is to make sure the screen is blank to the right of your Input prompt.

Michael Berry
Kewanee, IL

$97 ON...GOSUB trick—If you are using ON... GOSUB or ON...GOTO and the number of destinations cannot be fitted onto one program line, break the On statement into two lines:

```
100 ON P GOSUB 1000,2000,3000,4000,5000,6000,etc. to 12000
110 IF P 12 THEN Q=P-12
120 ON Q GOSUB 13000,14000,15000,16000,etc.
```

D.R. Cool
Huber Heights, OH

$98 ON X GOTO tip—There's a bug in the documentation for this statement. If X is negative or greater than 255, the program will *not* fall through to the next line. You will get an Illegal Quantity error.

Westmoreland Commodore Newsletter

$99 ON...GOTO application—There are many times when a Basic program needs to "hold" on a line waiting for user input of some type. A common way is:

```
10 GET A$: IF A$ = "" THEN 10
```

The trouble with this is that it "wastes" a whole program line. Here is another way:

```
10 GET A$: ON -(A$="") GOTO 10
```

As long as A$ = "" , i.e., no input, the line is executed over and over. As soon as a key is pressed, the ON... GOTO becomes invalid and execution will continue on the same line. So you could have something such as:

```
10 GET A$: ON -(A$="") GOTO 10: A=INT(X/256): B=X-
   256*A: etc....
```

This allows you to pack more on a line.

Doug Smoak
Columbia, SC

$9A Multiple-choice branching—There are times when it would be nice to have a test of a condition that does not default to the next line of Basic. By adding an If... Then statement before an ON...GOTO, we can have a "multiple-choice" branch, such as:

```
10 IF A>B THEN ON -(B=0) GOTO 100: GOTO 200
20 REM Continue if A not > B
```

Let's look at the possibilities of this example. If A *is not* greater than B, then line 20 would be executed. If A *is* greater than B and the condition in parentheses, B=0, *is also* true, then program control goes to 100. Finally, if A *is* greater than B and the condition in parentheses *is not* true, then GOTO 200 is executed.

This is similar to the If...Then...Else statement in some forms of Basic. Of course, you could have another ON...GOTO or If...Then statement or whatever in place of the GOTO 200 and the condition in parentheses can be anything allowable. This can at times give you some nifty code that saves several lines of testing.

Doug Smoak
Columbia, SC

$9B RND hint—Many programs call for something like X=INT(N*RND(0))+M. You can save time and keystrokes by using X%=N*RND(.)+M. The use of the integer variable form saves an INT, and the use of the period in the argument saves execution time.

S.A. Bennice
Roanoke, VA

$9C Improved PRINT@—Trick $17 of the February issue seems a cumbersome way to print at any position on screen. The following one line can be added anywhere in your program.

```
POKE214,12:PRINT:POKE 211,10:PRINT"RUN MAGAZINE"
```

In the above line, POKE 214 sets the line number and POKE 211 sets the column number.

(continued on p. 122)

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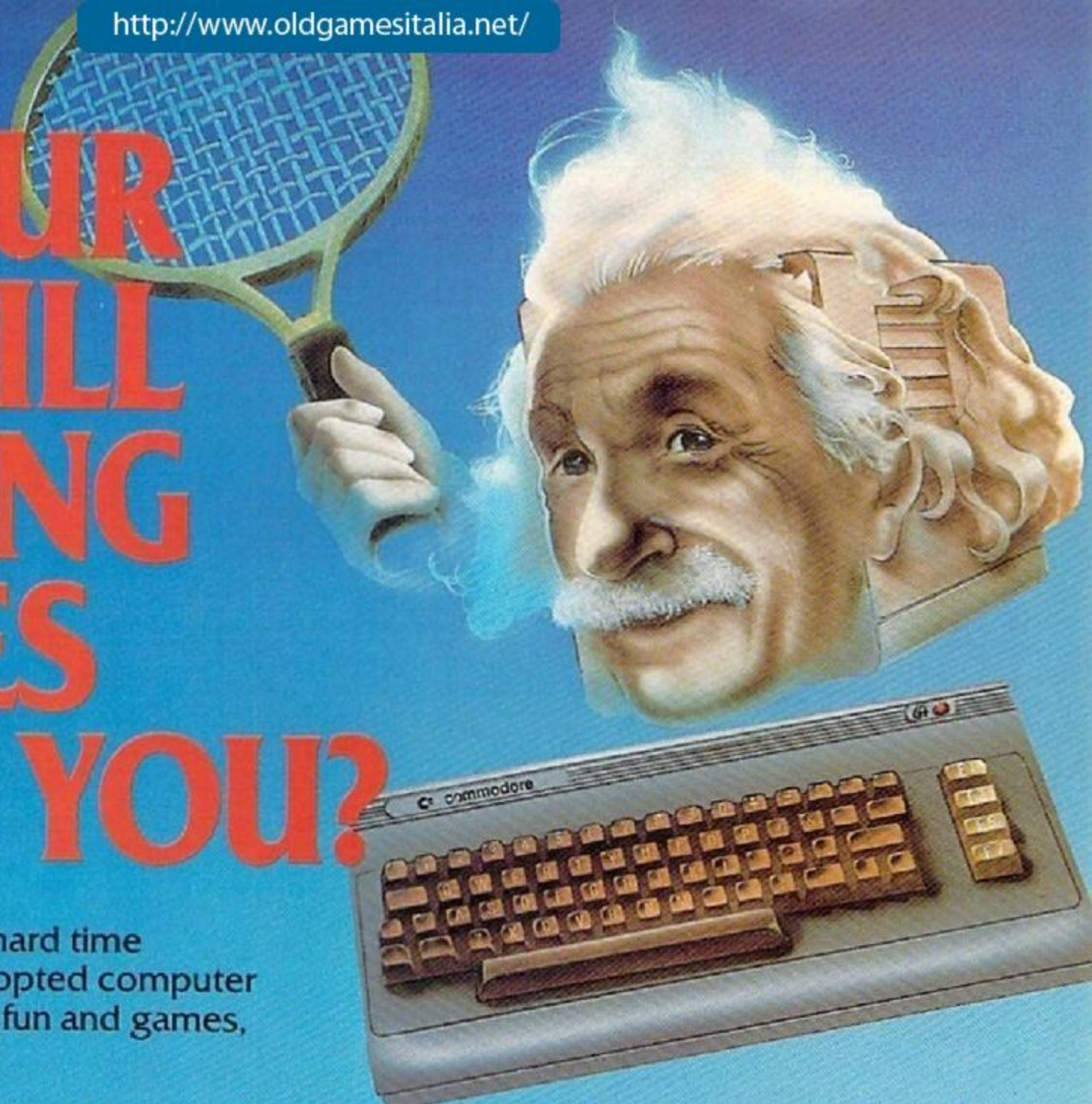

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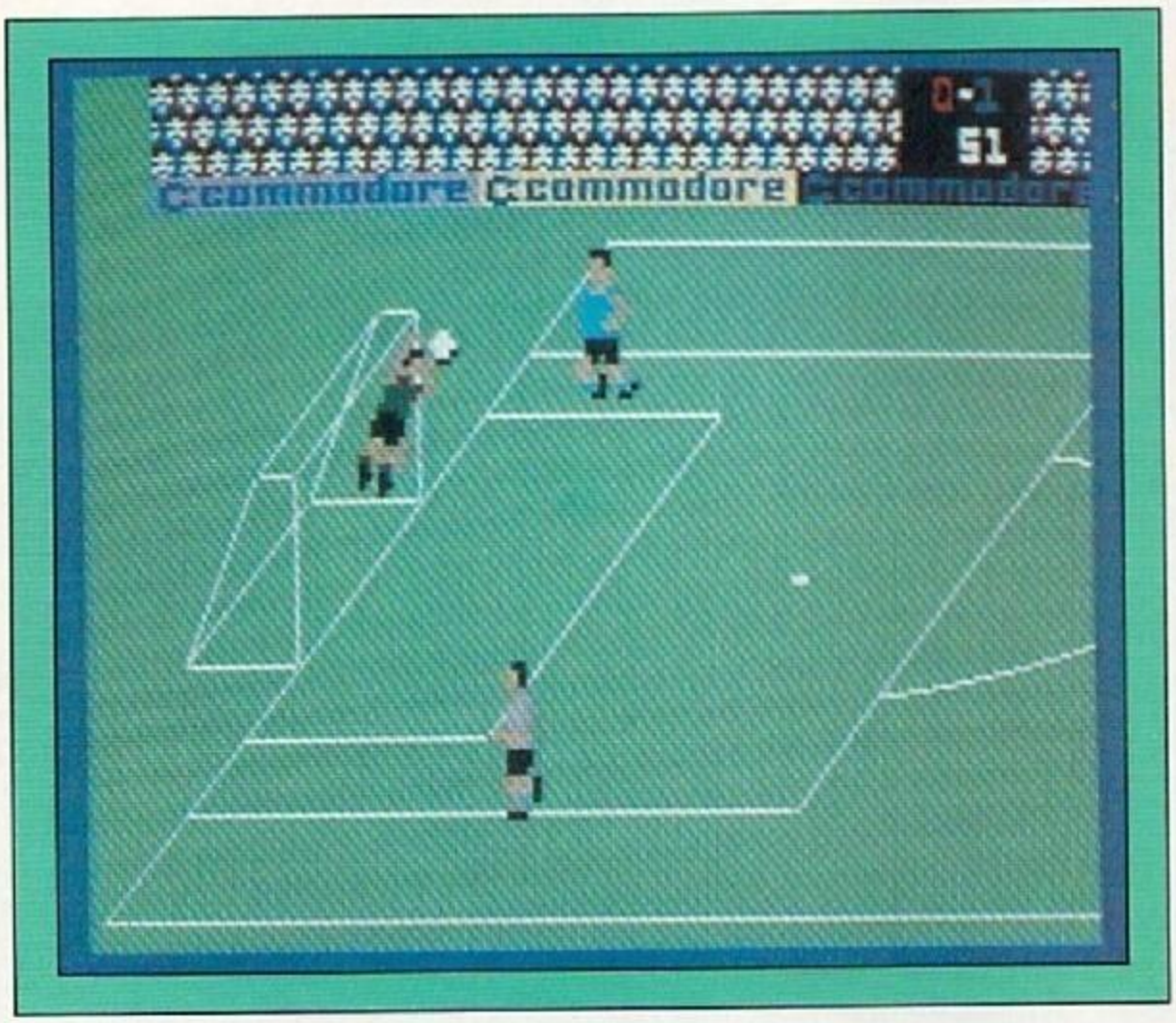

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C — **Good.** Lives up to its billing. No hassles, headaches or disappointments here.

D — **Mediocre.** There are some problems with this program. There are better on the market.

E — **Poor.** Substandard, with many problems. Should be deep-sixed!

International Soccer

Commodore's New Soccer Simulation Has Earned Its Gold Medallion

A

Loyal fans of any sport demand a lot from a computer simulation of their favorite pastime. They're likely to balk at anything that doesn't live up to the excitement and intensity of the real thing (and there's a lot of software out there to balk at). However, if you're a soccer enthusiast, you have a delightful surprise awaiting you with Commodore's International Soccer, a new game cartridge for the C-64.

This superb three-dimensional simulation admirably demonstrates the graphics potential of the Commodore 64. Your perspective of the field is similar to a television camera angle, enhancing the feel of a real sporting event.

The game has options for one or two players. You can select the jersey color of each team (blue, red, yellow, orange, white or gray). If you're playing against the computer, you can select the skill level of your opposition from one to nine.

There are six players and a goaltender on each team. A whistle sounds to start the action, and the clock starts counting down the seconds of the first half. (Every game is divided into two halves, lasting 200 seconds each.)

You have direct joystick control over only one of your players at any given time. This player changes to a different shade of the team color to distinguish him from the other players (red changes to pink, gray changes to black, etc.). The player in possession of the ball (or nearest the ball) is under joystick control.

You can move your joystick-controlled player in any direction. The fire button is used to kick the ball. The other players on each team run patterns in their respective zones, according to the movement of the ball. Only a portion of the playing field is visible at any given time—the field scrolls horizontally as play proceeds. Thus, there are moments when only a few players are visible; players constantly move on and off the screen during the course of the game. If a controlled player leaves the screen, control will be transferred to the on-screen player nearest the ball.

If the ball goes out of bounds, the whistle is blown, and a player from the team taking possession will automatically position himself on the sideline to throw it in. If your team is taking

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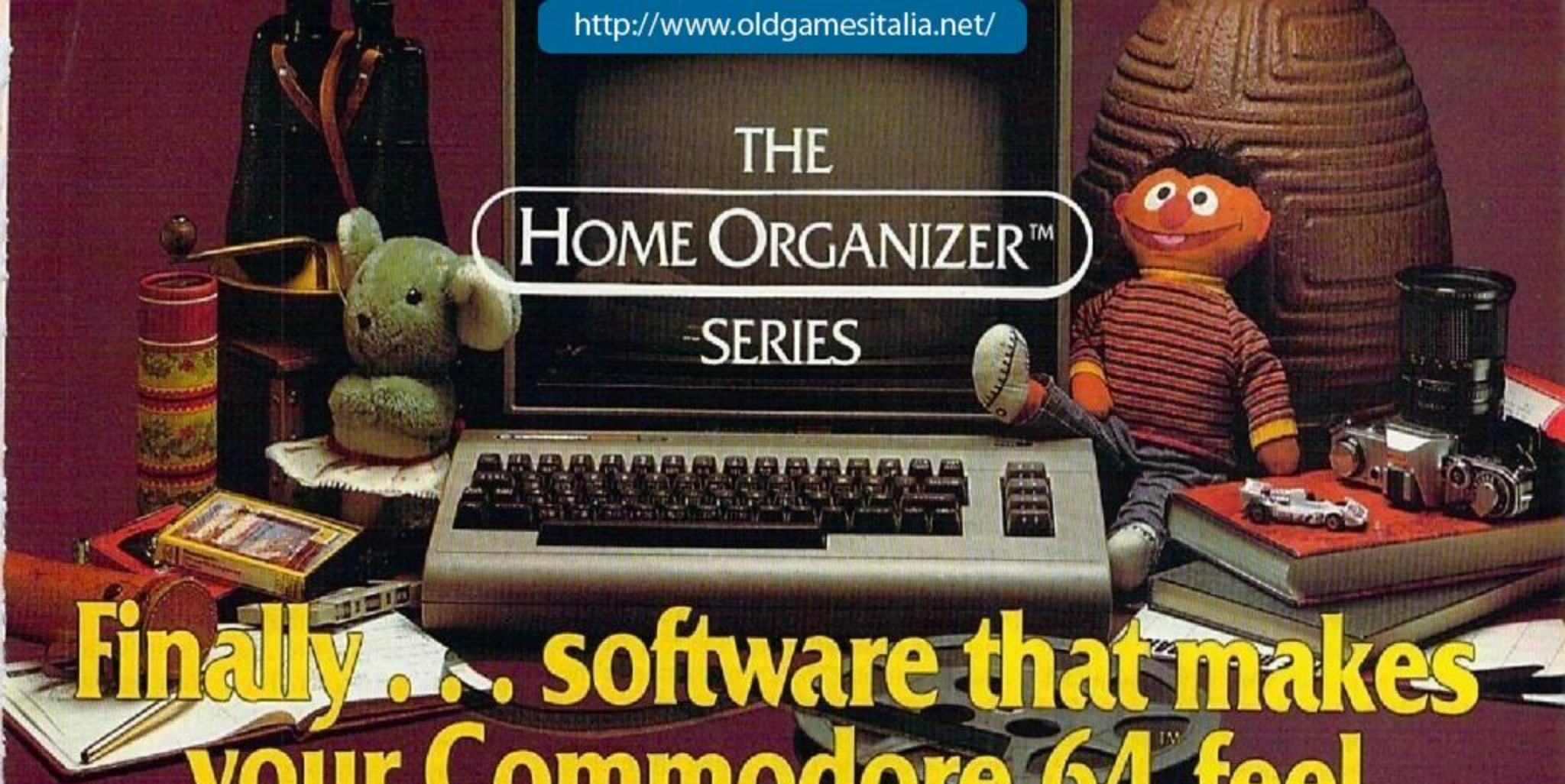

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Even if you're only lukewarm about soccer, you'll find the visual and sound effects of this game to be a real treat.

possession, you must press the fire button to throw the ball back into play. You can put your controlled player in position to receive the throw, but there's no time for delay—the ball will be thrown in automatically after a few seconds if you don't act quickly. Goal kicks and corner kicks are handled in a similar manner.

As you mount your offensive attack downfield, you can set up passing plays with the other players on your team. You can even "head" the ball! The player with the ball moves more slowly than the others, so you may frequently find yourself under heavy pressure from pursuing defenders, who come from all angles and attempt to steal the ball. (Good passing skills are a must!)

When you're on defense, you have control of your player nearest the ball. You must try to anticipate your opponent's strategy and attempt to steal the ball.

One thing you'll have to learn to become proficient at this game is the technique of transferring control from one player to another. Besides passing the ball, control can be transferred by intentionally moving your controlled player off the screen. For example, if you're on defense, and your controlled player can't catch up to the man with the ball, you can pull back on your joystick until your player goes off the screen. Control will then be transferred to another one of your players in a better position downfield. This technique can also be used effectively on offense.

When an opposing player breaks free to take a shot on goal, your goaltender becomes your controlled player. You must press the fire button to attempt a save. The goaltender will jump or dive to make the save, depending upon the angle of the shot. Shots made directly at the goaltender will be stopped automatically.

The scenario of International Soccer is very much like a real soccer game, and it's also rather amusing. At the start of the game, the players charge onto the field and take their respective positions. The pace of the game is very natural as the action proceeds up and down the field. The movement and bounce of the ball is very realistic—there's even a shadow underneath the bouncing ball. The animation of the jumping, diving goaltenders is superb.

When a goal is scored, the players run back to midfield amidst the roar of the partisan fans. (There's no rioting in the grandstands, however.)

At the end of the first half, the players jog off the field, giving themselves (and you) a brief rest. The teams switch sides for the second half.

When the final whistle blows, the players leave the field. The winning team (if there is a winner) comes back out and lines up at midfield. The crowd cheers as a woman in white presents a gold cup to the captain of the team!

The gameplay, though not as remarkable as the graphics, is nevertheless a satisfying challenge. Offensive and defensive strategies, similar to those of real soccer, can be applied here. When playing against the computer, the nine skill levels make the game accessible to all types of players. On level 1, your computer opponents give a lackluster performance in all phases of the game, sometimes scrambling about with no apparent sense of direction. On level 9, your opponents play like World Cup champs—their defense is flawless, and their offensive attack is relentless.

There are some limitations in this game. The movement of your uncontrolled players sometimes appears haphazard and unrelated to the movement of the ball. Once, as I mounted an offensive thrust downfield, I was a bit miffed to find one of my players standing motionless on the sideline with his back to the field. (He's been cut from the squad!)

Player movement is realistic, with a couple of exceptions. As players pursue each other and the ball, they sometimes appear to run through each other. Also, with the exception of the goaltenders, players cannot jump or fall.

The length of the game feels just about right—there are almost seven minutes of actual playing time in each game. However, there's no option to select longer or shorter games, which would have been a nice feature.

Despite these limitations, International Soccer has enough going for it to please just about everyone. Even if you're only lukewarm about soccer, you'll find the visual and sound effects of this game to be a real treat.

This is the first release in Commodore's Gold Medallion series, a designation reserved for a special category of new games. Future releases in the series will include a basketball game.

The series is off to a great start with International Soccer. Try it. You'll get a charge out of it. *(Commodore Business Machines, 1200 Wilson Drive, West Chester, PA 19380. $34.95.)*

Shawn Laflamme
***RUN* staff**

Moon Shuttle

The Prince of Darkness Awaits You in This Arcade Thriller

B

Nichibutsu's Moon Shuttle for the C-64, by Datasoft, is a multi-screen, slide-and-shoot game packing superior graphics and exceptional challenge.

Moon Shuttle puts you in control of a rotating, exhaust-spewing shuttle armed with a rapid-fire cannon. Head to head and solitaire options are available, though two controllers are needed for multiple-player games.

To help keep track of your six ships, the number of ships in reserve is displayed in the upper left (one player) or upper right corners of the screen. The F7 key or the fire button begins play, while the space bar pauses and resumes a contest underway. The F1 key aborts the present game and returns you to the Demo mode.

The object of this cosmic contest is to rack up as many points as possible while traveling through the game's various

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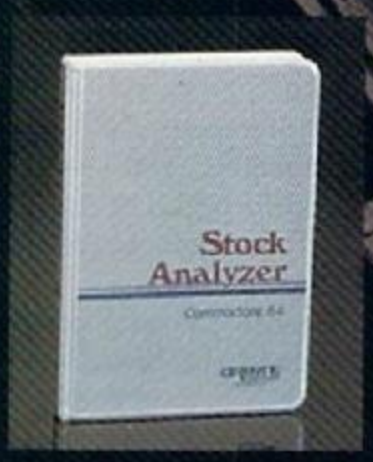

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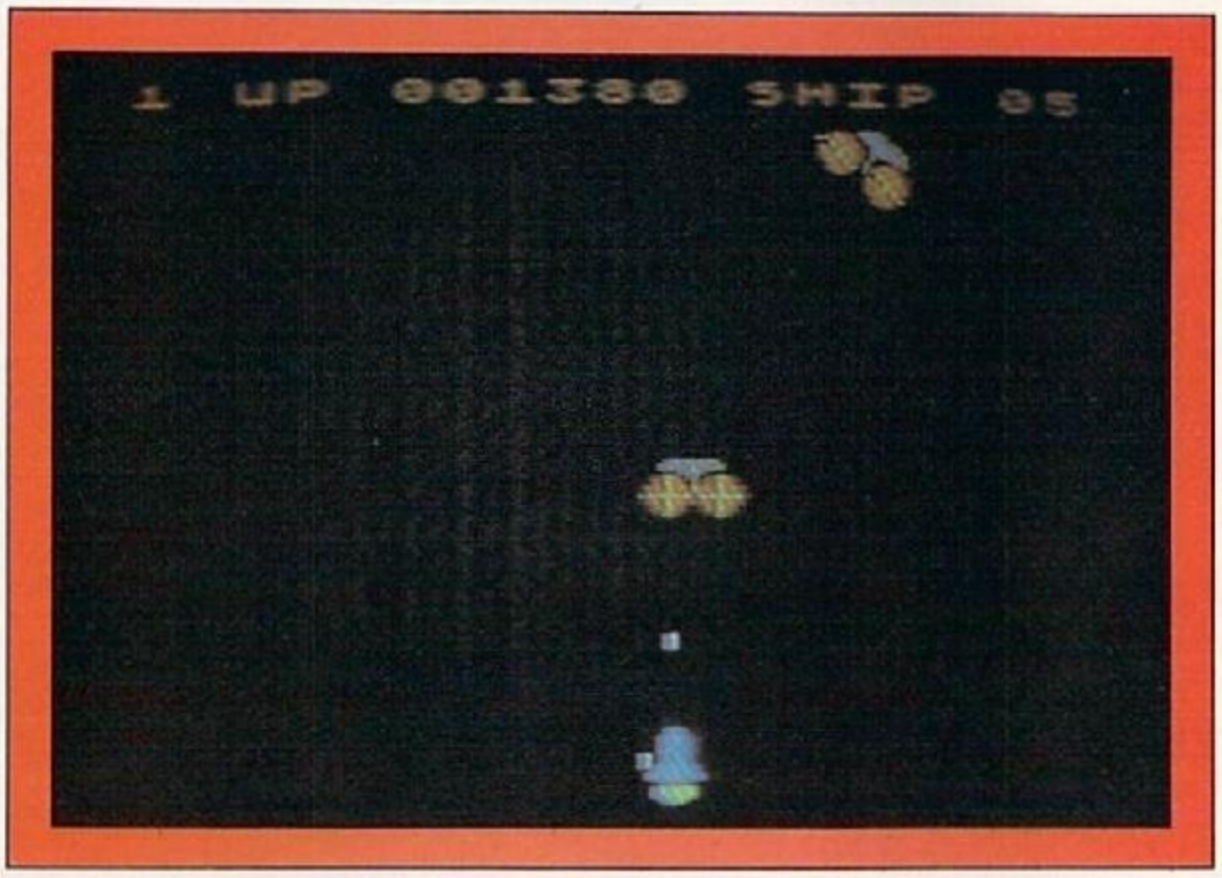
Moon Shuttle's aliens careen about, making precision shooting a wistful dream.



screens and increasing levels of difficulty. The first, and subsequent, odd-numbered screens consist of an asteroid belt—contact with an asteroid will destroy your shuttle on contact. You must blast a path through this wall of space debris to earn a bonus ranging from 500 to 2000 points.

Initially, the asteroids just hang motionless in space; afterward, rows of them travel horizontally in alternate directions. These shifting patterns are best handled by using a joystick such as the Spectravideo Quickshot II with its selectable rapid-fire switch.

Bomb launchers appear in the second scenario. These colorful turret-like aliens careen wildly about, making precision shooting a wistful dream. Just before they attack, however, they run a level pattern. Get them first, or face a deadly volley of white hot flak!

Looking like old Roman fasces with a blue aura, expandos move about in the frozen wastes of deep space, trying to end your mission. Single-fire into their ranks is a sure way to reduce their numbers. Since they expand and glow just prior to offensive action, you can maneuver your shuttle out of harm's way. Slaughtering them (or any other aliens) too quickly brings in heavy enemy reinforcements; therefore, a little shrewdness is required to keep them at manageable levels.

The crack troops arrive next. These are blue men-o'-war—jellyfish-like monstrosities that weave back and forth with an uncanny, unpredictable, undulating motion. With absolutely no warning, they blast away as they relentlessly encroach on your shuttle's travel lane, located on the lower part of the screen.

Blob men in three different sizes appear next, though somewhat anticlimactically. When hit, they subdivide (in the style of Demon Attack) into two medium-sized blobs. Hit again, they further divide into two even smaller blob men. A final hit sends them into "bloblivion."

Combrade, the Prince of Darkness, makes an appearance to turn the odds back in favor of the blob men. As he moves across the top of the screen, tracking your shuttle's navigational course, he fires deadly bolts. You'll have to keep up a steady stream of fire to defeat Combrade before he has a chance to draw a bead on your shuttle. Also, keep your eyes open for mystery ships traversing the asteroid fields!

The control responses in Moon Shuttle are instantaneous and fluid. The visuals are sharp, extremely detailed and bursting with color. The animation of the individual aliens is simply outstanding!

Though the bonus can reach 2000 points, normal targets are worth only 10 to 50 points. This is a bit low considering that you need 20,000 points for an extra shuttle. Thus, a lot of shooting, coupled with agile maneuvering, is needed to successfully pilot your shuttle to new heights.

As with other Datasoft offerings, both tape and disk versions are included in each package.

Moon Shuttle is a well-executed, challenging space battle enlivened by exceptional graphics. *(Datasoft, Inc., 19808 Nordhoff Place, Chatsworth, CA 91311. $34.95.)*

Ted Salamone
Bridgeport, CT

Multiplan

Increase Your Productivity With This Sophisticated Electronic Worksheet

One of the hottest-selling financial software products, Microsoft Multiplan, is now available for your Commodore 64, from Human Engineered Software. A personal productivity tool for both the home and office, Multiplan is a serious program with a variety of powerful features.

On the surface, Multiplan is a spreadsheet program that gives you a large grid of cells (63 columns by 255 rows) to work with. In this grid, you can enter text, numbers and formulas to suit your needs. But Multiplan goes beyond the normal spreadsheet program.

In fact, it's more of an electronic worksheet. For example, besides being able to set up budget or investment records, you can quickly do charts, mail lists, inventories, perform sorts and easily handle moderate amounts of data in the manner of a database, while viewing all your data at the same time.

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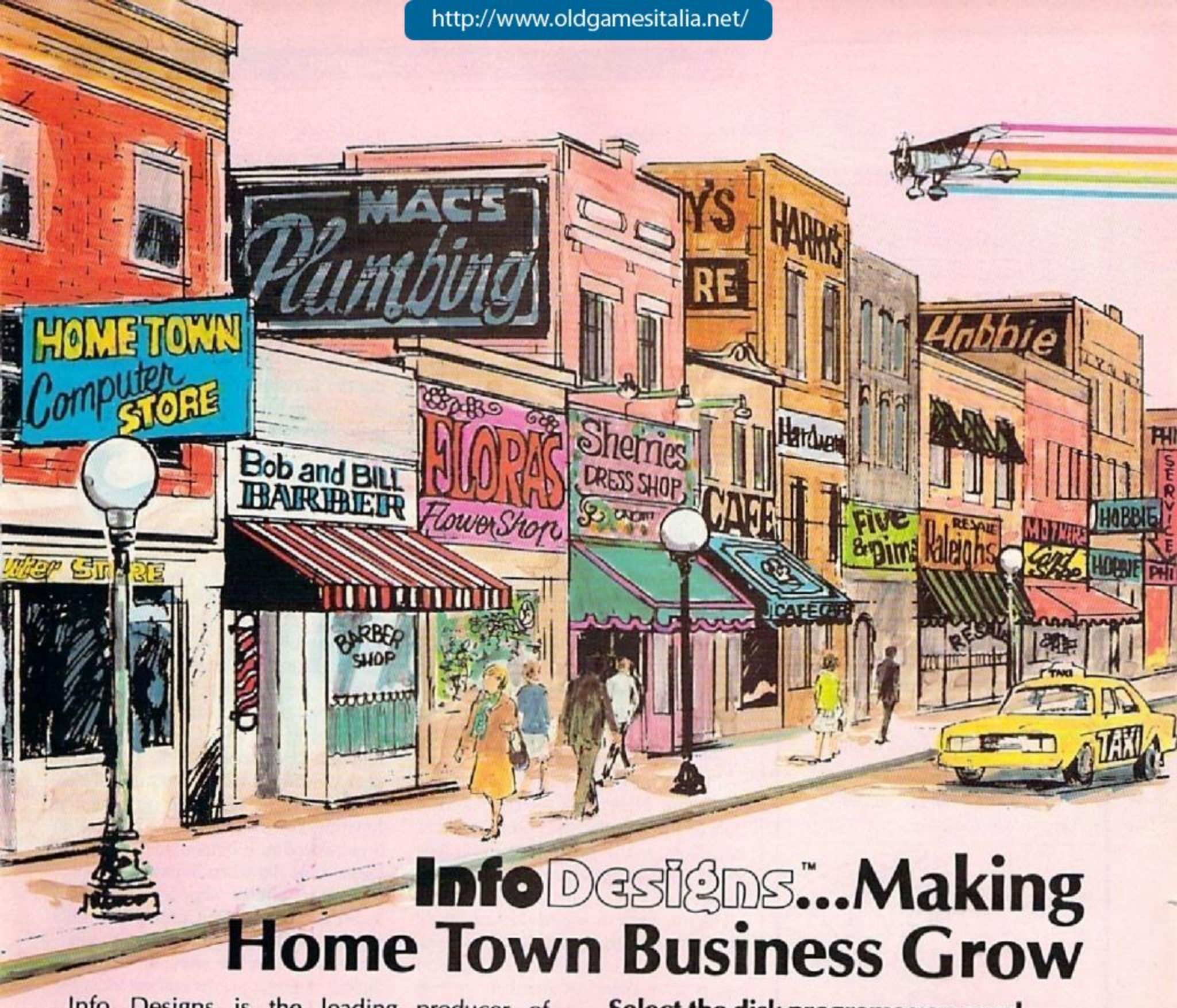

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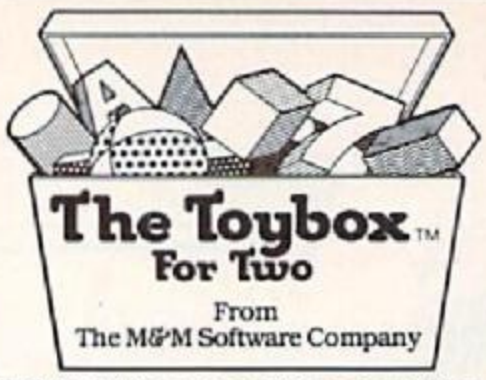

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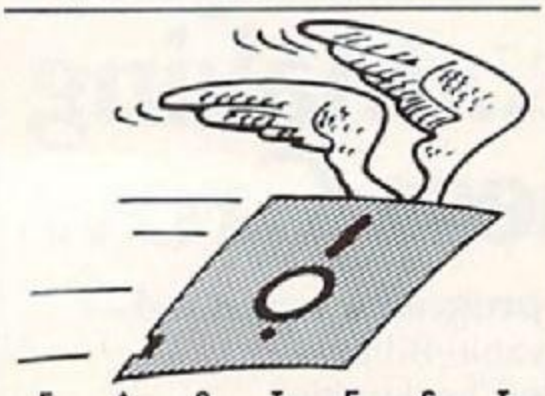

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Software Gallery

Using Multiplan

Using Multiplan is easy. After the initial load, you see a grid on your screen, a command line, a status line and an illuminated cell pointer. The command line displays major commands (English words such as Copy, Transfer, Move, Insert, Blank and Delete). By selecting one of these commands, you put Multiplan to work for you.

For example, to enter numbers, just move the cell pointer (or large cursor) to the desired cell, and then enter the number. Multiplan assumes you are entering numbers unless you select the Alpha command. To enter text, such as titles, just select the Alpha command and then type in the desired letters.

All major commands remain at the bottom of your screen for quick reference. There are also secondary command lists presented as certain main commands are chosen. For example, the Transfer command lets you load and save your worksheets to disk. When you select Transfer, a second command line appears with commands such as Load, Save, Rename and Delete.

The bottom screen line is called the status line. Here you'll see the cell location of the pointer, the content of that cell (if any), the percentage of storage space available and the worksheet (file) name.

As you learn to use Multiplan, you'll discover more and more useful features, such as file linking. With linking, you can overlay sheets of numbers or text and develop other charts without having to re-enter data. You'll also find an automatic load procedure, which will be very helpful if you don't have very much computer experience. Also, individual column widths can be changed up to a maximum width of 32 characters.

The Manual

While all this may sound complicated and difficult to learn, it really isn't. All it takes is careful reading of the manual and practice. The manual is excellent and will answer almost any question that you might have. It's over 400 pages long and divided into two parts—a tutorial guide and a reference section.

The tutorial guide takes you through all the fundamentals while you actually do a sample worksheet. Besides the basics, you'll learn how to enter formulas, name cells, set up windows, print a worksheet and use more than one worksheet at a time.

The reference section is more technical and covers each command in detail. Finally, there are appendices containing helpful hints, a glossary, notes for VisiCalc users and other special topics.

You don't really have to wade through the entire manual—after studying the initial tutorial sections, you can start using Multiplan. For even more help, the program has an on-line help system. When you get stuck, just ask for help and Multiplan responds with on-screen Help displays.

More Strong Points

Multiplan has many strong points going for it. For example, a start-up procedure is included, letting you combine your data disks with Multiplan help and system files. This means you won't have to make frequent disk changes after the initial load of Multiplan.

All eight of the Commodore 64's function keys are used well. The Multiplan package includes a Quick Reference Guide (a summary card) and a function key overlay card. The manual is contained in a binder that allows the pages to lie flat when in use.

As for printer support, Multiplan works nicely with the Commodore 1525 printer or any printer properly interfaced to the serial port. It does not directly support printers attached to the RS-232C user port.

Warranty coverage includes free replacement of a faulty disk up to 180 days after purchase, and then replacement for a $2 fee after that. A backup disk is also available for $10.

Overall, Multiplan for the Commodore 64 is a very professional, well-designed package. There is very little to fault in it. However, there are two areas of concern that you should be aware of.

First, once Multiplan is loaded, you cannot change screen color combinations. This means you have to poke the required values before loading the program. Instructions for doing this are included in Appendix 6 of the manual.

The second concern is with the 1541 disk drive. Since Multiplan is a very disk-interactive program, your 1541 disk drive must be performing correctly. If it has any degree of head misalignment or

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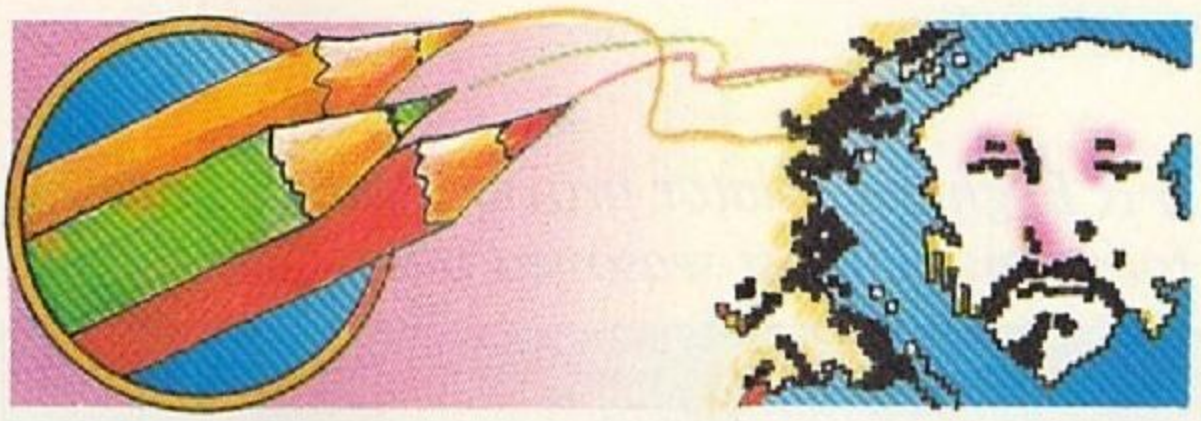
other variations leading to frequent read or write errors, you may lose data or find Multiplan somewhat difficult to work with. This isn't a fault with Multiplan—it is, rather, a system issue. So, make sure your disk drive is working correctly before blaming Multiplan for disk filing errors.

Final Comments

Multiplan for the C-64 is a serious tool for home and business use. At $99.95, it's a bargain, especially when compared to the program's price for other computer models (two to three times higher). Just be sure to allow yourself sufficient time to learn Multiplan in order to get the maximum benefit from it.

So, if you really want to put your Commodore 64 to work, consider Multiplan. I highly recommend it, as long as your printer and interface will work with it. If you're not sure, have your dealer try it using the same equipment you have. *(Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005. $99.95.)*

Larry Bihlmeyer
Pontiac, MI



Doodle!

Create Your Own Masterpiece With This Commodore 64 Graphics Program

Finally, there's an easy-to-use program that really makes use of the great graphics capabilities of the Commodore 64—Doodle!, from City Software.

Doodle! is advertised as a "color sketch pad." It uses easy-to-follow instructions and on-line menus to provide quick access to many features. Using 100% machine language, Doodle! is very responsive to your commands.

Just what can Doodle! do for you? Let's look at each of the program's ten modes.

1. *Sketch.* Here you can sketch free-style using a joystick or trackball to move the "pen." The sketch pad gives you nine pen sizes and erasers to work with. Sixteen colors are also available for drawing and painting.

2. *Line.* This mode lets you draw a straight line between any two points. With this feature, you can easily create diagrams, diagonal lines and triangles.

3. *Circle.* With this mode, you can create circles and ovals with the press of a button. They can be located anywhere on the screen and filled in with any colors that you choose.

4. *Box.* Similar to the Circle mode, the Box mode allows you to easily create boxes of any shape.

5. *Letter.* This mode lets you type keyboard graphics, letters and numbers on your screen sketch pad. You can then enlarge them, make them smaller and turn them upside down, among other variations.

6. *Copy.* Here you select a box size to memorize, then save it. Once saved, it can be recalled and located anywhere. Also, the size, shape and orientation of the box can be changed.

7. *Stamp.* This mode is useful for making multiple copies of a part of your doodle. This mode requires less work than the Copy mode.

8. *Zoom.* This is a great feature that lets you zoom in on any part of your doodle to add fine detail. You can also scroll the screen to take a closer look at any part of the doodle.

9. *Color.* Here you can paint to your heart's delight. A color box allows you to choose different colors and apply them wherever you want. Advanced color features are also included, allowing you to control colors down to a pixel.

10. *Disk and Print.* You can save your doodles on disk and produce hardcopies on your printer. The program is designed to work with the Commodore 1525 printer connected to the serial port. It does not support printers hooked to the RS-232C port. Some other printers are supported (when properly interfaced to the serial port), including C. Itoh 8510, NEC 8023, Epson, Star/Gemini, Prowriter and Okidata.

All of the above features can work together on your doodle, giving you great creative flexibility. For example, Doodle! can be used to create graphic art, educational displays, charts, illustrations for reports, monograms, logos and letterheads.

Doodle! also has other outstanding features that work with all drawing modes. These include cursor sensitivity control, mirror and negative images and screen grid.

There are nine levels of cursor sensitivity (speed), from very fast movement to very slow and controlled movement. Mirror image instantly produces a mirror image of your doodle, while negative image produces a reverse-contrast doodle. Screen grid allows you to create a lined grid (like graph paper) on your screen.

Overall, Doodle! is a very good buy and an exceptional program to work with. The manual is well-prepared and easy to follow. The only things missing from the manual are reproductions of the screen menus, which would make it easier to learn the program.

If you get lost or make errors, Doodle! is very forgiving. Errors are handled well, and you can easily get back to main menus without destroying your doodle.

Doodle! is appropriate for almost any age range, since reading skills are not necessary to use some of the joystick drawing modes. I would put the lower age limit at about six. Just make sure your printer and interface will work with Doodle! if you want to make hardcopies.

Warranty coverage for a faulty disk includes free replacement for the first 90 days with proof of purchase. Technical

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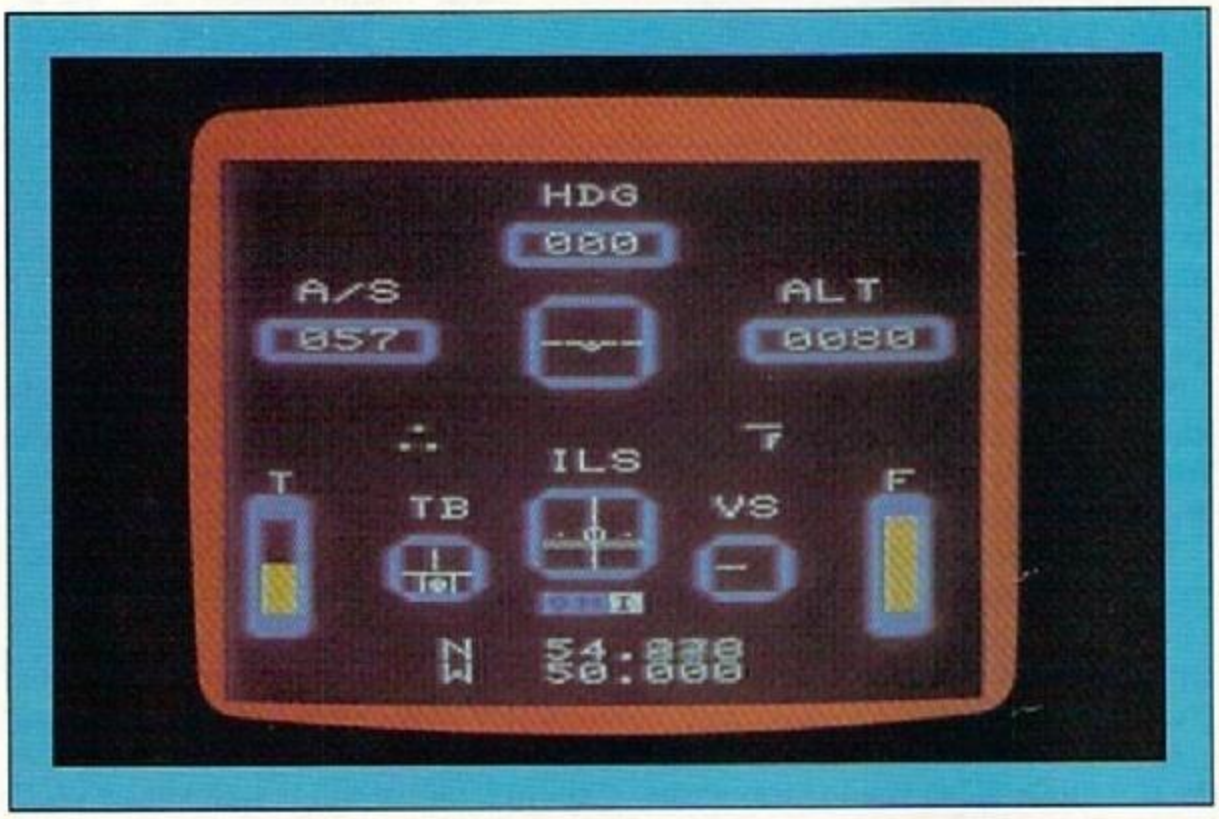

support is also available from City Software, either by phone or mail.

Doodle! is a good value with a wide range of features. It'll show you a lot about the graphics capabilities of your Commodore 64. *(City Software, 735 W. Wisconsin Ave., Milwaukee, WI 53233. $29.95.)*

Larry Bihlmeyer
Pontiac, MI

IFR Flight Simulator

Put Yourself in the Cockpit Of a Light Plane and Prepare for Takeoff!

B

Outside of my cockpit, the fog has closed off my view. As I prepare for takeoff, I listen to the reassuring purr of my engine grow louder as I push down on the throttle. The tachometer slowly rises and my runway speed begins to increase.

As the airspeed indicator sweeps past 55 mph, I pull back on my joystick. My artificial horizon shows me to be climbing. I confirm the climb by glancing to my right at the altimeter, which shows a slow ascent. I press my landing gear retraction switch and look at the three lamps to the left of my compass. A red light indicates that my landing gear is firmly retracted and my airspeed indicator shows a small increase as the drag of the landing gear disappears. I'm off!

At 400 feet, I level my wings by referring to the artificial horizon, reduce my airspeed and begin to turn west toward my destination.

This flight was accomplished with my Commodore 64 and the IFR Flight Simulator, from Academy Software. The simulator is available on tape or disk for the C-64 and on cartridge for the VIC-20.

IFR stands for instrument flight rules. When weather conditions such as fog, rain or sleet reduce visibility, a pilot must fly by his instruments. This is the scenario for which the IFR Flight Simulator was written.

The screen displays a complete set of navigational instruments including a compass, airspeed indicator, artificial horizon, altimeter, landing gear status lights, flap position indicator, tachometer, fuel gauges, instrument landing system, vertical speed indicator, turn indicator, distance-measuring equipment and an automatic direction finder.

Using your joystick, you can climb or descend and bank to the right or left. The computer keyboard is used to control throttle setting, switching between fuel tanks, nose attitude, nosewheel steering, wheel brakes, flaps, landing gear, the instrument landing system and the automatic direction finder.

The plane has the characteristics of a light, general aviation aircraft similar to the Cessna 172RG. Jet plane speeds can't be achieved here—if you exceed 220 mph, you'll tear the wings off your plane!

The manual, which is very well prepared, includes four pages of maps. You start your flight at airport number one, and then fly to as many of the other airports as you can. Each airport offers different navigational aids and facilities. At two of the four airports, no fuel or repair services are available, so you must plan the order in which you will approach the fields or you will find yourself at 1000 feet without fuel.

If you crash, the program announces the cause of your failure. Whether you stalled and spun into the ground, ran into a mountain, or forgot to lower your landing gear, your mistake is displayed in text on the screen.

There are edit modes that allow you to practice separate portions of flying—a nice feature that saves you from having to start from the beginning each time you want to practice.

The program makes good use of the sound capabilities of the C-64. The engine sounds very much like the engine of a light plane. The stall warning, which goes on when your airspeed falls so low that it causes your plane's wing to dip and nose to fall, sounds exactly like the stall warning device on a general aviation aircraft.

Whether you're a seasoned pilot or a beginner, the IFR Flight Simulator is guaranteed to deliver a generous portion of aerial thrills. *(Academy Software, PO Box 6277, San Rafael, CA 94903. $29.95.)*

Jerome Beck
Glendora, CA

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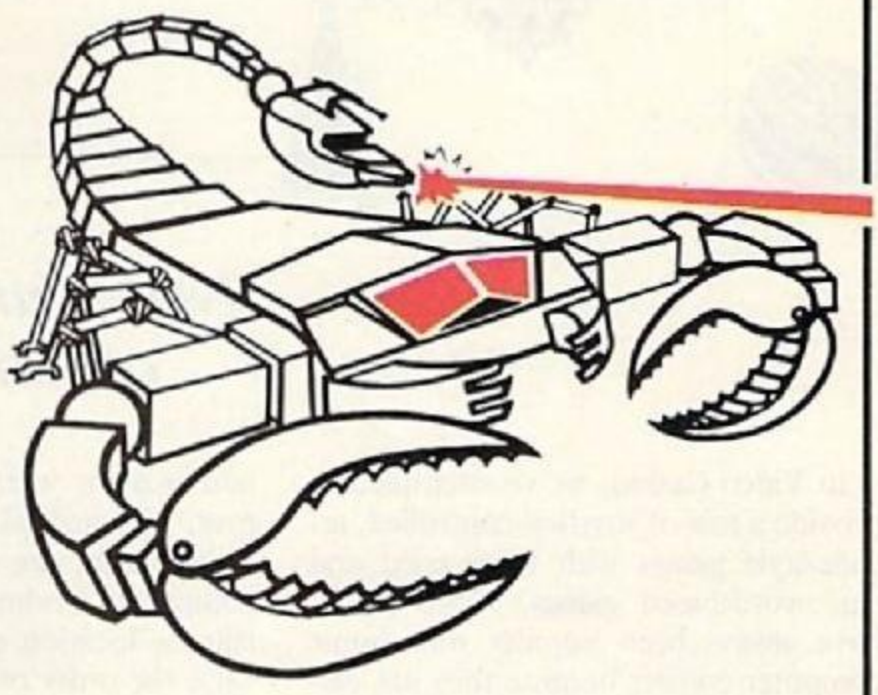

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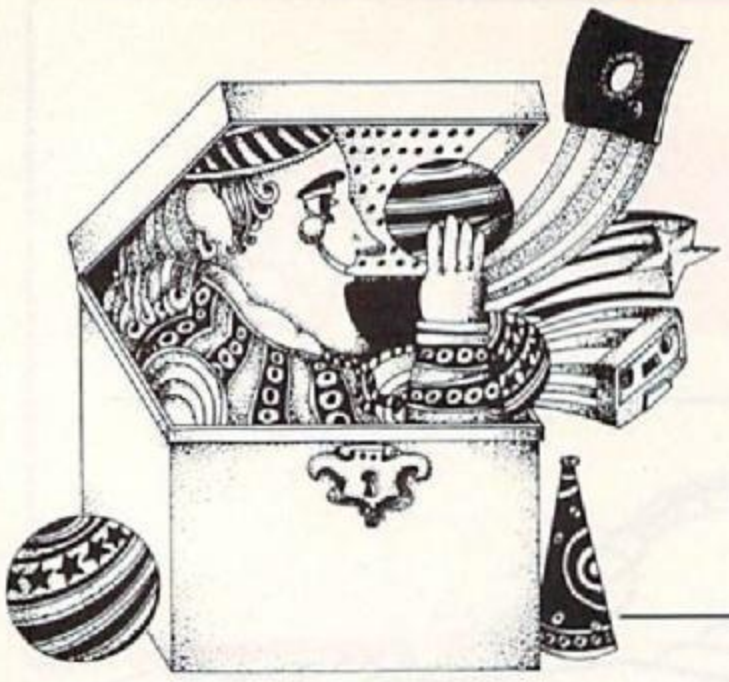

Video Casino

By David D. Busch

You might not be able to find even your own name in the maddening maze of jumbled letters this program contrives.

In Video Casino, we've attempted to provide a mix of joystick-controlled, arcade-style games with some tried and true word-based games. Word games have always been popular with home computer owners because they are easier to write and play than those involving complex graphics.

Word Search is a variation on the games in which a word or series of words are hidden in a matrix of letters. You are given a suggested list of starter words, but may add your own list to make the game more challenging. Don't worry about a familiar word becoming too easy to find—you'd have difficulty locating your own name in the word maze built by this game!

Hiding the Word

In this variation, only one word is hidden at a time, within a 15-×15-letter matrix. The word may be hidden horizontally or vertically, forward or backward, but not diagonally. The Commodore 64 and VIC-20 track the amount of time spent searching and reward you for finding the word quickly.

Ten sample words are included with the program in lines 200 to 240 (lines 190 to 230 in the VIC listing). You may add as many words as you want. However, repeated playings, even with the same words, are challenging, since the computer randomly chooses a new starting location each time and can reverse the order of the letters, creating a different matrix.

Since a matrix is nothing more than a two-dimensional array, we store the letters in an array, PZ$(15,15). Once the computer has placed the target word in the array, the remaining positions are filled with letters chosen at random.

Each round, the computer first selects a number from 1 to 4. This number, C, will point to the way the word will be hidden: horizontally, horizontally reversed, vertically or vertically reversed. Next, the existing array is given the null value to remove any old letters deposited by the previous round.

The program then reads a new word, WRD$, from the data, and branches to one of four subroutines. When you choose to have a word hidden horizontally or horizontally reversed, the computer randomly chooses a row (from integers 1 to 15) in which to hide it.

Next, the computer chooses a random starting position, PO. Since only 15 positions are available, but words are longer than one letter, not all the positions are legal. In other words, you cannot begin a seven-letter word at position 10 if it's to be read horizontally forward, because there would not be enough space left in that row. So, the computer calculates P1 to find out how many spaces are available.

Then, For...Next loops deposit the letters of the word in the array row using MID$. For placing the letters in the same order in which they appear, the ordinary For...Next loop is used. To reverse them, a reversed loop (that is, with a Step command of −1) does the

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VIC-20
Commodore 64

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trick. A counter, CU, lets you remove letters, starting from the beginning of the word, however.

You hide the word vertically and vertically reversed in the same way, except that a random column, COL, is chosen instead of a row.

The next step is to fill out the array with random letters. Nested For... Next loops take care of all the rows and columns in the array. The computer checks to see if an array element is already occupied. If not, then a random CHR$, ranging from CHR$(65) (A) to CHR$(91) (Z), is placed there. The array is then displayed.

You are allowed to guess, with the elapsed time used to measure performance. If you guess correctly and achieve a new record, the computer announces your achievement.

A Bigger Puzzle

The game provides plenty of challenges with a 15 by 15 matrix. This size puzzle will safely fit on the 22-column screen of the VIC-20. You can, however, increase the fun by enlarging the matrix. The Commodore 64 could display a 30 by 20 matrix on its 40-column screen. If you trim or combine the prompt lines at the bottom of the screen, even the VIC-20 could use a larger matrix, on the order of 15 by 20.

A larger matrix will require a number of changes other than cosmetic screen reformatting. First, of course, PZ$ (row,col) will have to be enlarged. The For...Next loops that give the null value to the array, or that fill or print it, also will have to be enlarged.

The lines that choose the random position for starting to hide the word should be changed, too. Hint: A good candidate for change, should you enlarge the puzzle size, is anywhere that the value 15 (the current limit of the matrix) appears in the program.

For example, in lines 360 to 390 of the Commodore 64 listing, you select the word's starting position by subtracting the length of the word from 15 to see how many positions remain, then choosing one of those as the starting position. If your new dimension is 20, you'd substitute 20 for the value of 15. This means, of course, that your clue words can be longer than those used for the original version of this program.

Be certain you save a copy of the program before you start your modifications. That way, you'll always have a correctly running version in reserve, should you get hopelessly lost or fouled up. R

Listing 1. Word Search program for the VIC-20.

```
10 REM ***************
20 REM *{13 SPACEs}*
30 REM * WORD SEARCH *
40 REM *{13 SPACEs}*
50 REM ***************
60 PRINT"{SHFT CLR}{2 CRSR DNs}"
70 PRINTTAB(6)"{CTRL 6}{CTRL 9}WORD SEARCH{CTRL 7}{2 CR
   SR DNs}"
80 PRINTTAB(1)"YOU WILL BE SHOWN"
90 PRINTTAB(1)"A WORD.{2 SPACEs}TRY TO "
100 PRINTTAB(1)"FIND IT IN PUZZLE AS"
110 PRINTTAB(1)"QUICKLY AS YOU CAN.{2 CRSR DNs}"
120 PRINTTAB(1)"ENTER ROW, COLUMN OF"
130 PRINTTAB(1)"FIRST LETTER OF WORD.{2 CRSR DNs}"
140 PRINTTAB(6)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL 7}"
150 GET A$:IF A$="" GOTO 150
160 PRINT"{SHFT CLR}"
170 DIM PUZ$(15,15)
180 REC=999999999
190 DATA COMPUTER, KEYBOARD
200 DATA COMMODORE,PROGRAM
210 DATA DISKETTE,MONITOR
220 DATA GRAPHICS,VERIFY
230 DATA COMMAND,DIMENSION
240 C=INT(RND(1)*4)+1
250 FOR R=1 TO 15
260 FOR C1=1 TO 15
270 PUZ$(R,C1)=""
280 NEXT C1
290 NEXT R
300 READ WRD$
310 PRINT"{SHFT CLR}"
320 PRINT WRD$
330 ON C GOTO 340,440,560,680
340 ROW=INT(RND(1)*15)+1
350 P=LEN(WRD$)
360 P1=15-P
370 PO=INT(RND(1)*P1)
380 C2=PO+1
390 R2=ROW
400 FOR N=1 TO LEN(WRD$)
410 PUZ$(ROW,N+PO)=MID$(WRD$,N,1)
420 NEXT N
430 GOTO 780
440 ROW=INT(RND(1)*15)+1
450 P=LEN(WRD$)
460 P1=15-P
470 PO=INT(RND(1)*P1)
480 C2=PO+P
490 R2=ROW
500 FOR N=P TO 1 STEP-1
510 CU=CU+1
520 PUZ$(ROW,N+PO)=MID$(WRD$,CU,1)
530 NEXT N
540 CU=0
550 GOTO 780
560 COL=INT(RND(1)*15)+1
570 P=LEN(WRD$)
580 P1=15-P
590 PO=INT(RND(1)*P1)
600 R2=PO+P
610 C2=COL
620 FOR N=P TO 1 STEP-1
630 CU=CU+1
640 PUZ$(N+PO,COL)=MID$(WRD$,CU,1)
650 NEXT N
660 CU=0
670 GOTO 780
680 COL=INT(RND(1)*15)+1
690 P=LEN(WRD$)
700 P1=15-P
710 PO=INT(RND(1)*P1)
```

(continued on p. 116)

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For Gamesters Only

By Tom Benford

Hail and felicitations to all ye of stout heart and valiant spirit! Seek no further for want of a quest, thou noble adventurers, for herein are veritable treasures for thy gaming hearts!

Contained on these parchments lie the courses of maze and wonder, of enigmas and puzzlements, of riches beyond belief, but alas, the way is frought with danger. If ye be pure of soul, hearty of self-will and think thyself to be strong of both body and spirit, then step boldly forth. But thou must first answer this riddle: "Knowest thou what this month's column be about?"

If you answered, "adventure games," you're right! We're going to be visiting surreal worlds of both the past and future, as we look at three adventure games for your Commodore computer.

Before we don our suits of chain-mail armor and pick up our broadswords, just a quick reminder to vote for your favorite joystick. Let's see if we can get votes from all 50 states, okay? Just a few lines in a letter or postcard, to let me know what your favorite joystick is and why you like it. Send your votes, as well as any other comments, questions or anecdotes to:

Tom Benford/RUN
PO Box 4125
Osborneville, NJ 08723

In a future column, I'll tally up the votes and let you know what sticks were the most popular and why. I'll also be doing a feature spread on joysticks, so your input on the subject is important. Okay...'nough said.

Now...gird up your loins, gather your sacks of potions and supplies, buckle on your trusty swords, mount your steeds and follow me into the realm of adventure games....

Crush, Crumble and Chomp!

(C-64 disk and VIC-20 cassette with 16K Expander from Epyx Inc., 1043 Kiel Court, Sunnyvale, CA 94086.)

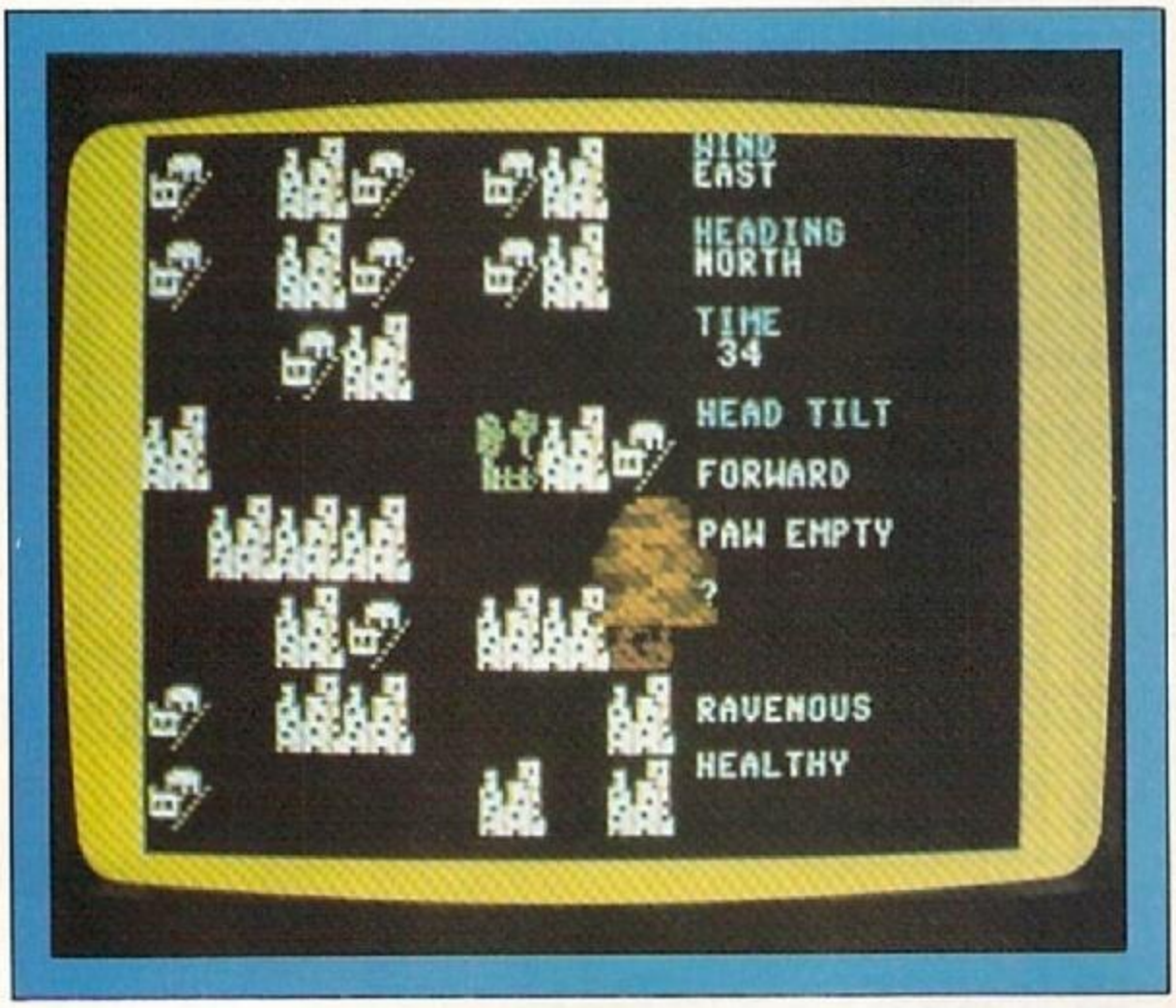
Remember those "B" horror movies, like Ratzilla Burps on Washington and King Kong Tangles with the Tucson Tarantula? Ever want to see the monster win one for a change? Ever get tired of being the hero and want to be the heavy instead? If you answered yes to one or more of the above, then Crush, Crumble and Chomp! is definitely for you.

In this novel adventure, you can choose which movie monster you want to be (from a choice of six), which city you'd like to terrorize (from a choice of four), and your planned course of destruction (from a choice of five game objectives). All in all, you're offered over 100 possible scenarios.

In addition, after you've chosen what you want to be, where you want to go and what you want to do, the opening screen credits roll by, explaining the cast of characters (good and bad), the locale and the status. Then off you go, raining death and destruction, instilling terror in the hearts of the public and, in general, wreaking havoc while having one heck of a good time.

Epyx has once again merged the best of both worlds in CC&C by combining graphics, sound, animation and text all into the same game. Monster movement is achieved through the keyboard, and playing time ranges from ten minutes to one hour in this single-player action adventure.

CC & C is lots of fun for the whole family, for extremely entertaining and humorous touches heighten the gaming experience. What other game offers you the Golden Gate Bridge for dinner?



For the slightly sinister game player.

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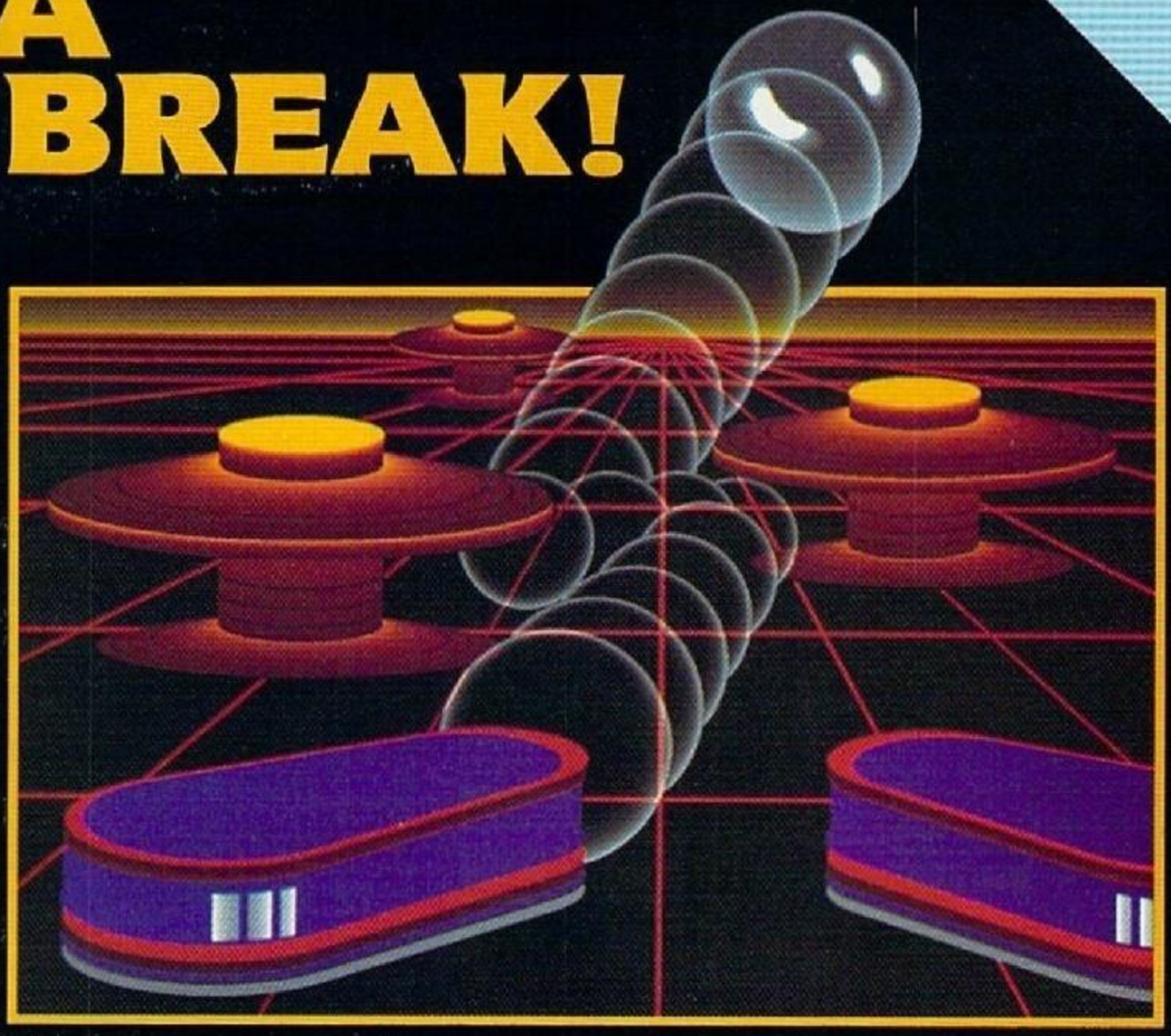
TAKE A BREAK!

For Commodore 64



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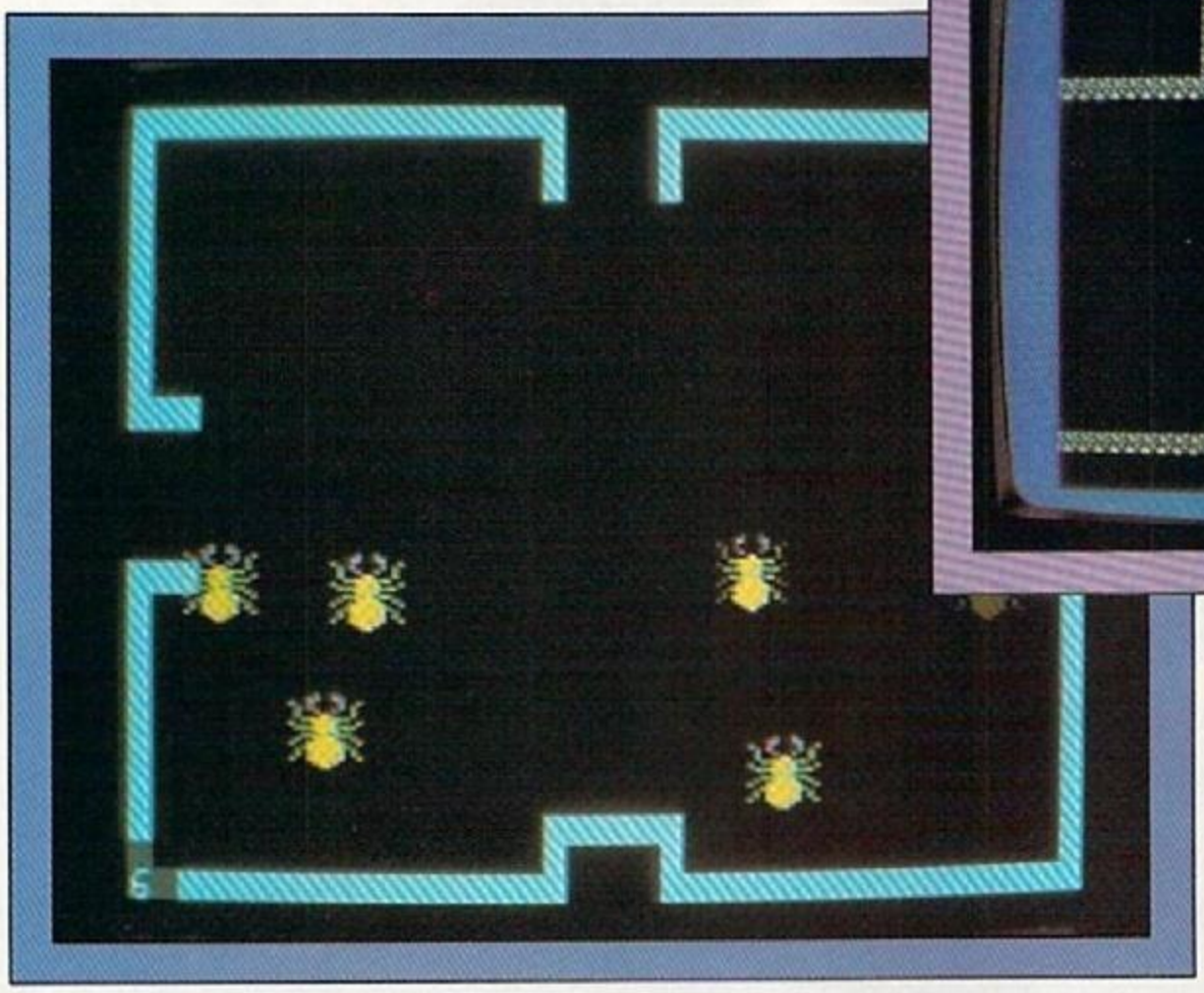
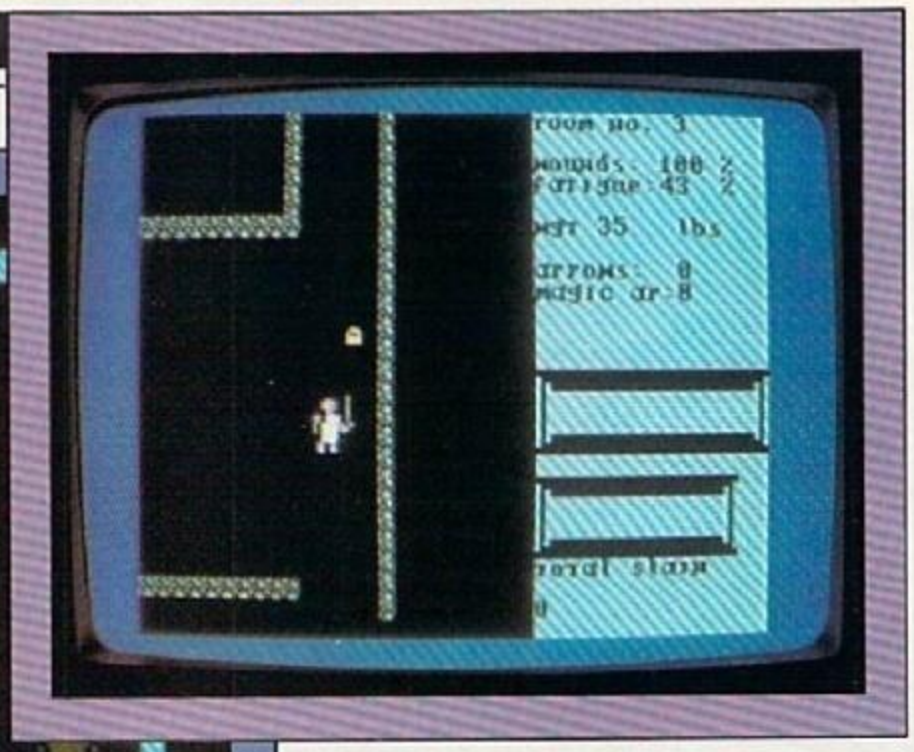


This game looks easy, but it's fraught with challenges.



Do you dare enter the fantasy world of Apshai?

Labyrinth of the Creator

(C-64 disk from Victory Software, 7 Valley Brook Rd., Paoli, PA 19301. $19.95.)

In Labyrinth of the Creator, Victory Software has come up with an ingenious idea—the duplex game disk, which contains the game along with other programs. Pretty slick, huh?

In addition to the game, the disk also contains some valuable programming hints, a preview of other games available from Victory and a catalog of their products. You certainly get value for your gaming dollar.

You begin your journey into the labyrinth with ten men. Play-action is controlled via the joystick. Some of the hazards you'll have to overcome include robots, skulls, lakes, avalanches, false creators and a deadly monster that continuously roams through the rooms and corridors.

Amongst the treasures you're likely to encounter are a boat and keys (which will unlock various chambers). The boat will be useful for crossing the lake and the keys will unlock doors to chambers and rooms, which contain other keys and treasures.

The ultimate goal is to find the evil creator and destroy him. This is no easy task, since he's protected by a powerful generator, which must be first rendered inoperative. Danger and death lurk in every corridor, around every corner and within every room in this addicting action adventure.

Graphics are good, play-action excellent and the sound acceptable in this simple-looking but hard-to-master game. The play-mechanics and objective are easy enough for even the youngest adventurers, but the challenge level will keep the accomplished quester on the edge of nervous frustration.

Temple of Apshai

(C-64 disk from Epyx Inc., 1043 Kiel Court, Sunnyvale, CA 94086.)

Before you start your quest into the Apshaian dungeon, you'll have to barter and haggle with the innkeeper for your necessary supplies and weaponry. You'll also be given the opportunity to name your surrogate character (or revive one from a previous game). Play-action is achieved through the keyboard rather than the joystick, and both a helpful command summary card and a book of lore are included with the game.

Upon completing your negotiations with the innkeeper for your sword, armor, shield, bow and arrows and magical salves, most of your time in the dungeon will be spent exploring the 200 rooms on the four different levels. Along the way, you'll find some 80 different types of treasures, but be cautious—they'll be surrounded by traps and guarded by all sorts of unsavory monsters.

Temple of Apshai is the great granddaddy of computer adventures. Having made its debut a few years back for the Apple, it's now finally available for the VIC and C-64. In this fantasy world, you and you alone control what direction the adventure will take—the choice is always yours, whether to fight or flee, parry or thrust, slay the demons and monsters or try to reason with them. One thing is certain—no two games will ever be the same!

An extremely handy feature is the ability to store a character or game in progress, which you can revive at some future time to continue the adventure. This feature is a real boon, since playing time ranges from 30 minutes to infinity!

Everything about Apshai is top-notch—graphics, sound (sparse but good) and play-action. It's a journey into a fantasy world filled with incomprehensible treasures and hair-raising danger...a world that only the most stalwart adventurers will emerge from ...alive! R

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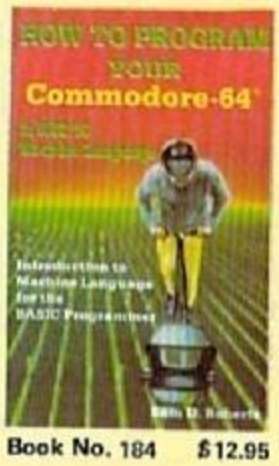

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Play Ball!

Lead the League With Your C-64...

By Paul Howe

Every summer, millions of us aging adolescents dig out the gloves, bats and balls and head for the parks and playgrounds, to try to recapture our "glory days" on the baseball diamond. We don't run as fast, hit as hard or react as quickly as we used to, but the attempt brings back memories, and the satisfaction of a well-stroked base hit or perfect throw is just as great as ever.

If you're like me, you've even gone so far as to join a team in a softball league or some other league organized for ball players who want to go have some fun and rekindle those old memories. And if your team is like mine, everyone proclaims that "It's not whether you win or lose...," while at the same time, one of the most frequently heard remarks at any practice or game is "Where's the stat sheet?"

Sure, fun and teamwork *are* important, but those individual stats are paramount. What ballplayer in any league doesn't love to see his statistics in print (unless, of course, he's in a slump)?

Softball Stats, written for the Commodore 64, will enable you to keep track of all your team members' offensive statistics without the drudgery of the mathematical calculations that drive so many scorekeepers batty. And, if you have a printer, you can produce a professional-looking printout that will impress your teammates not only with their own unmatched talents, but with your computing abilities.

Each week, you just load the previous totals (from either tape or disk) and add the new individual stats. The program will figure the new individual totals and the new team totals, and then will display the new stats sorted by any category (i.e., at bats, hits, runs, runs batted in, walks or batting average). You can then save the new totals to tape or disk and request a hard copy, again sorted by any category.

Address all author correspondence to Paul Howe, 209 Sunset Ave., Santa Cruz, CA 95060.

How to Use Softball Stats

When Softball Stats is run, a menu is displayed, offering the following options.

1. Load Previous Stats
2. Add New Data
3. Sort and Display Stats
4. Save New Totals
5. Add Players
6. Print Stats
7. Quit Program

The first time you use the program, you must enter the players' names by choosing option 5. As written, the maximum number of players is 20, but that can be expanded by simply changing the DIM statements in line 10. Also, due to limitations of the 40-column screen, the

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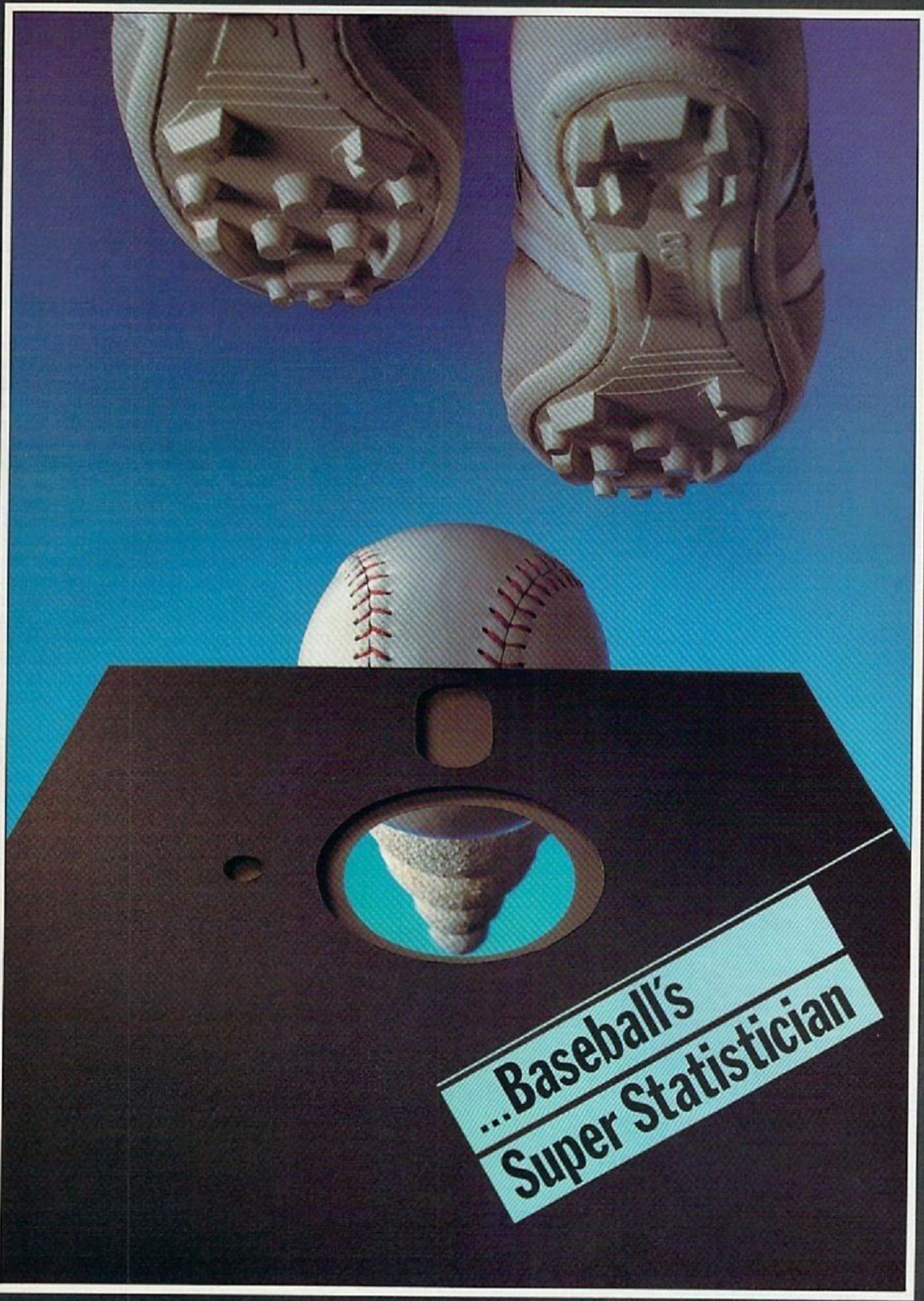

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Softball Stats Is "The Natural."

SOFTBALL STATS THROUGH GAME # 4

NAME	AB	H	R	RBI	BB	AVG
HAROLD	14	9	5	5	4	.643
RAHN	7	4	2	0	2	.571
CARLOS	6	3	3	3	3	.500
PAUL	17	8	4	4	2	.471
GARY	11	5	2	2	2	.455
ROBERT	7	3	3	2	2	.429
RON	10	4	0	0	0	.400
PERRY	5	2	2	1	3	.400
TOM	19	7	3	2	2	.368
JOHN	14	5	2	1	1	.357
JUAN	9	3	1	1	1	.333
CHUCK	12	4	0	2	1	.333
STEVE	11	3	2	2	2	.273
TOTALS	142	60	29	25	25	.423

Table. Softball stats through game 4.

Listing of Softball Stats program for the C-64.

```
10 DIMA(20,6),B(20,6),C(20,6),N$(20),A$(20),B$(20),M(6)
   ,T(6),U(6)
20 NP=0:AD=0:NA=0
30 POKE53280,11:POKE53281,11:PRINTCHR$(5)
100 REM ****************** MENU *****************
110 PRINTCHR$(147):PRINT:PRINTTAB(12)"SOFTBALL STATS"
120 PRINT
130 PRINT:PRINT"{4 SPACEs}1{3 SPACEs}LOAD PREVIOUS STAT
    S"
140 PRINT:PRINT"{4 SPACEs}2{3 SPACEs}ADD NEW DATA"
150 PRINT:PRINT"{4 SPACEs}3{3 SPACEs}SORT AND DISPLAY S
    TATS"
160 PRINT:PRINT"{4 SPACEs}4{3 SPACEs}SAVE NEW DATA"
170 PRINT:PRINT"{4 SPACEs}5{3 SPACEs}ADD PLAYERS"
180 PRINT:PRINT"{4 SPACEs}6{3 SPACEs}PRINT STATS"
190 PRINT:PRINT"{4 SPACEs}7{3 SPACEs}QUIT PROGRAM"
200 PRINT:PRINT
210 C=0:INPUT"{9 SPACEs}ENTER YOUR CHOICE";C
220 IFC<1ORC>7THEN210
230 ONCGOSUB1000,2000,3000,4000,5000,8200,11000
240 GOTO100
1000 REM ********* READ OLD DATA FROM TAPE OR DISK ****
     *****
1005 PRINTCHR$(147):GOSUB9800:IFTD$="T"THEN1011
1010 OPEN2,8,2,"0:SOFTBALL "+GN$+",S,R":GOTO1015
1011 OPEN2,1,0,"SOFTBALL"
1015 INPUT#2,GM
1020 PRINTCHR$(147):PRINT"SOFTBALL STATS THROUGH GAME #
     ";GM:PRINT
1030 GOSUB10000
```

More

program limits name length to eight characters each. When you have finished entering all the players' names, enter END at the prompt, and you'll be returned to the menu.

Normally, the options would be chosen in the order in which they appear on the menu, with the exception of Add Players, which I don't use much after setting up the file on the first run. As the program is written, however, it doesn't make any difference what order you follow.

You can add players in mid-season, for example, either before or after loading the previous totals, or you can load the totals, then re-sort and display them either before or after you add the new data. Or you can get a new hard copy of the previous stats by simply loading them and having them printed. However, there is one caveat. New data can only be added one time per run, as the second set of Input statements will overwrite the first.

You can make two file copies on separate disks during any run. You can't make a backup copy of a file by loading, then immediately saving; instead, you must first sort, display, print or add data.

To see how to use the program, we'll go through a sample run in mid-season. When the menu appears, enter 1 to read the data you've accumulated so far. You are asked whether you're using tape or disk, and you enter D for disk. Then you are asked for the number of the last game for which you recorded data. If you respond with 3, the disk drive whirs, and soon the screen displays a list of the players' names, their stats and the team totals through game 3, sorted as they were when you saved them. Hit a key to return to the menu.

RUN It Right

Commodore 64
1541 Disk Drive
or Datassette

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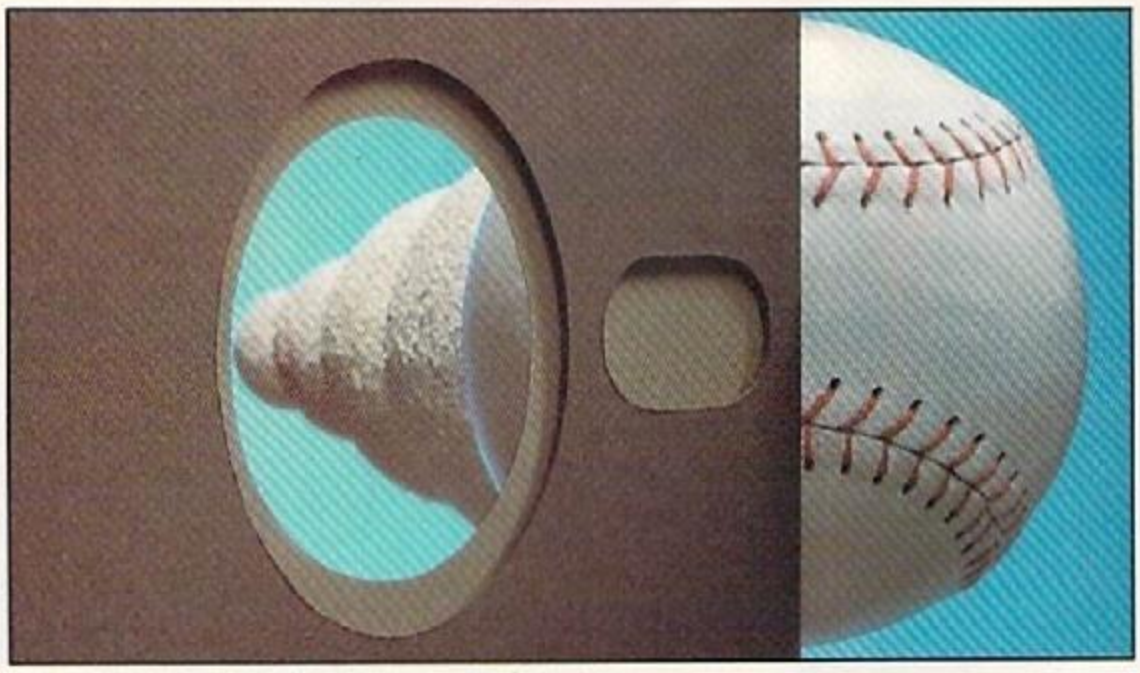

Listing continued.

```
1035 NA=NP
1040 NP=NP+1:INPUT#2,N$(NP)
1050 IFN$(NP)="END"THENNP=NP-1:GOTO1070
1060 GOTO1040
1070 FORI=NA+1TONP
1080 FORJ=1TO5
1090 INPUT#2,A(I,J)
1100 NEXTJ
1110 INPUT#2,A$(I)
1130 PRINTN$(I);
1140 X=8
1150 FORK=1TO5
1160 PRINTTAB(X)A(I,K);
1170 X=X+5
1180 NEXTK
1182 IFA$(I)="1.000"THENX=X-1
1185 PRINTTAB(X+1)A$(I)
1190 NEXTI:CLOSE2
1192 FORI=1TONP:FORJ=1TO5
1194 C(I,J)=A(I,J)
1196 NEXT:NEXT
1200 GOSUB6000:GOSUB6100
1205 IFTD$="D"THEN1230
1210 PRINT:PRINT:PRINTTAB(9)"*** TURN OFF TAPE ***"
1220 IFPEEK(192)<>0THEN1220
1230 GOSUB9500
1240 RETURN
2000 REM ************ INPUT THIS WEEKS DATA ************
2005 PRINTCHR$(147):PRINT"{6 SPACEs}INPUT NEW DATA":PRI
     NT:PRINT
2007 AD=1
2010 FORI=1TONP
2020 PRINTN$(I)
2030 GOSUB8500
2060 GOSUB2500
2070 PRINT
2080 NEXTI
2090 GOSUB10000:GOSUB8000
2100 REM CHECK FOR ERRORS
2105 PRINT:PRINTTAB(12)"CHECK FOR ERRORS"
2110 PRINT:PRINT"{4 SPACEs}HIT 'E' TO CORRECT INPUT ERR
     ORS"
2120 GETK$:IFK$=""THEN2120
2130 IFK$="E"THENGOSUB7000
2140 PRINTCHR$(147):PRINT:PRINT"{4 SPACEs}COMPUTING..."
2165 REM *** ADD NEW DATA TO OLD
2170 FORI=1TONP
2180 FORJ=1TO5
2190 B(I,J)=B(I,J)+A(I,J)
2200 NEXTJ
2210 GOSUB2500
```

More

If you then choose Add New Data, the program will print a player's name and prompt you to input the number of at bats, hits, runs, RBIs and walks. After the numbers for all players are entered, a table of the new data is displayed and you're asked to double-check for accuracy. If there was an Input error, simply hit E, and enter the name of the player (or players) on which there were mistakes, and you'll be prompted to reenter that data.

Now the computer does its main work. It updates each player's totals to reflect the new data and refigures the batting averages and the team's totals. Now, if you choose Sort and Display Stats, a submenu appears, asking by which category you wish to sort. If you enter 6 for Average, a table will appear on screen, listing the players and their stats in descending order of batting average.

After you inspect the new totals, you can sort them by another category, save them and/or print them out. You may, of course, print more than one hard copy, sorted in different ways.

If at some point you find there has been a scorekeeping change and you must adjust a player's stats after they've been saved, you may reload the file and input negative numbers to subtract a hit, a time at bat and so on.

There is one problem with this method if you use a disk drive. As written, the program uses the game number as part of the filename, so that, if needed, any week's stats can be found and loaded later in the season.

For example, if you load the stats through game 7, change a few totals and try to resave as game 7, you'll get a File Exists error. This could be overcome by using a Save With Replace (I haven't had trouble with this DOS command, though I've read that some people have) or by saving the corrected file to a different disk. The simplest fix may be to adjust the stats of the player to be changed the next time you run the program for the whole team.

The statistical categories used in this program are arbitrary and fit my team well (for example, we don't hit home runs, so I don't have a category for them). If you wish to change a category, it's fairly simple. If you want to keep track of home runs rather than runs scored, simply replace R in lines 8260 and 10010 with HR and replace RUNS in lines 8530 and 9050 with HOMERS. *Caution*: do not change At Bats, Hits or Average in this manner, as these categories are interdependent in program calculations. You may add categories,

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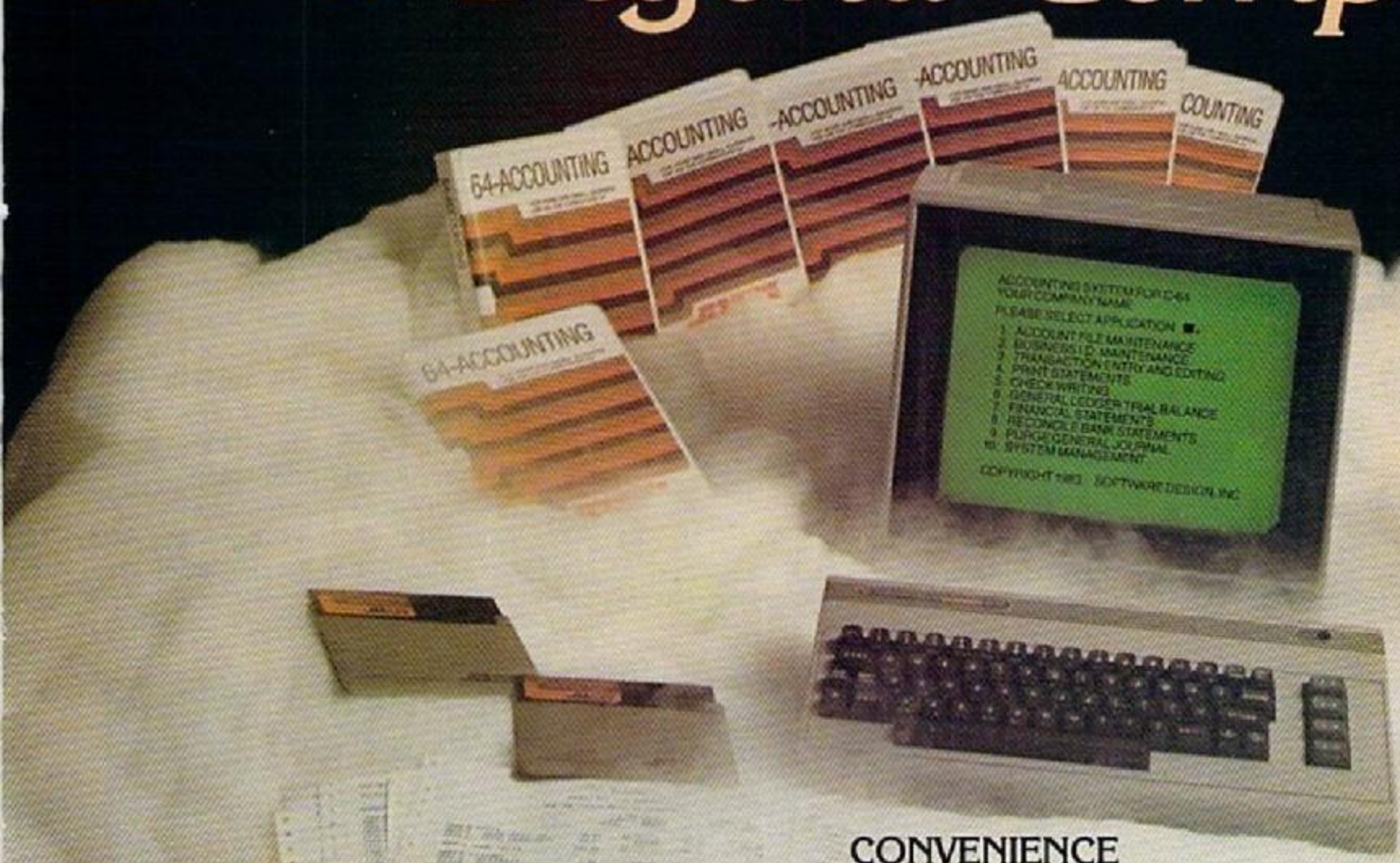

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Listing continued.

```
2230 NEXTI
2240 GOSUB8800:GOSUB6000
2250 RETURN
2500 REM *************** COMPUTE AVG ***************
2510 IFB(I,1)=0THENB(I,6)=0:GOTO2550
2520 B(I,6)=B(I,2)/B(I,1)
2530 B(I,6)=INT(B(I,6)*1000+.5)/1000
2540 IFB(I,6)=1THENB$(I)="1.000":GOTO2600
2550 IFB(I,6)=0THENB$(I)=" .000":GOTO2600
2560 B$(I)=STR$(B(I,6)):L=LEN(B$(I))
2570 IFL=3THENB$(I)=B$(I)+"00":GOTO2600
2580 IFL=4THENB$(I)=B$(I)+"0"
2600 RETURN
3000 REM ************* SHELL SORT *********************
3005 IFAD=0THENAD=1:GOSUB2170
3007 GOSUB9000
3008 PRINTCHR$(147);:PRINT"{2 SPACEs}COMPUTING...."
3010 N=NP
3020 G=INT(N/2)
3030 IFG=0THEN3160
3040 FORI=1TON-G
3050 IFB(I,S)>=B(I+G,S)THEN3100
3060 FORJ=1TO6:T(J)=B(I,J):U(J)=A(I,J):NEXT
3062 T$=N$(I):TB$=B$(I)
3070 FORJ=1TO6:B(I,J)=B(I+G,J):A(I,J)=A(I+G,J):NEXT
3072 N$(I)=N$(I+G):B$(I)=B$(I+G)
3080 FORJ=1TO6:B(I+G,J)=T(J):A(I+G,J)=U(J):NEXT
3082 N$(I+G)=T$:B$(I+G)=TB$
3090 E=1
3100 NEXT
3110 IFE=0THEN3140
3120 E=0
```

More

but it will be a little more complicated.

When you use a disk drive, Softball Stats works best with 18 or fewer players, due to the 25-line screen size and the necessity of displaying category headings and team totals. With cassette, it is best to have 16 players or fewer, since there are extra prompt lines on screen. Certain Print statements could be removed to increase player capacity.

How the Program Works

For those who may wish to modify the program for their own needs, the following is a description of the major routines in the program, and how they work.

Lines 10–30—initialization. Line 10 dimensions the appropriate arrays. As written, the maximum number of players is 20, and there are six statistical categories. Variable NP keeps track of the number of players, AD is a flag that keeps track of whether or not new data has been added and NA holds the number of players added, if any, before reading in the file data. Line 30 sets screen, border and print colors.

Lines 100–240—main menu.

Lines 1000–1240—load previous data. Lines 1005–1011 determine whether to

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load from tape or disk and issue the appropriate Open command. Lines 1015–1190 input data from storage, put it in arrays A(x,y) and A$(x) and print it to the screen. Line 1035 is a check to see if new players have been added before data was loaded.

If so, the players' names that come in from tape or disk are numbered accordingly in array N$(x). Lines 1192–1196 transfer the information just loaded into array A(x,y) into array C(x,y). This is done so that the Team Totals calculation and display subroutines at 6000 and 6100 can be used here and by other parts of the program, as well. Line 1220 is executed only if cassette tape is used, and it checks to make sure that no buttons on the cassette machine are engaged before the program continues. Location 192 holds this information.

Lines 2000–2600—input new data. Flag AD is set in line 2007 for future use. Lines 2010–2080 get the new data inputs and put them in array B(x,y). Line 2090 prints the new data, so that the user can check for accuracy in the error-checking routine (lines 2100–2140).

New data is added to previous data in lines 2165–2250, and the new totals are now stored in array B(x,y). The new

Listing continued.

```
3130 GOTO3030
3140 G=INT(G/2)
3150 GOTO3030
3160 PRINTCHR$(147):PRINT:GOSUB10000
3165 PRINT:GOSUB8000:GOSUB8800
3170 GOSUB6000:GOSUB6100
3180 PRINT:GOSUB9500:RETURN
4000 REM ******** SAVE NEW STATS TO TAPEOR DISK *******
     **
4002 PRINTCHR$(147):PRINT:PRINT
4005 GOSUB9800:IFTD$="T"THEN4011
4010 OPEN2,8,2,"0:SOFTBALL "+GN$+",S,W":GOTO4015
4011 OPEN2,1,1,"SOFTBALL"
4015 PRINT#2,GA
4020 FORI=1TONP
4030 PRINT#2,N$(I)
4040 NEXT
4045 PRINT#2,N$(NP+1)
4050 FORI=1TONP
4060 FORJ=1TO5
4070 PRINT#2,B(I,J)
4080 NEXTJ
4085 PRINT#2,B$(I)
4090 NEXTI
4100 CLOSE2
4102 PRINT:PRINT:PRINTTAB(12)"NEW STATS SAVED"
4104 IFTD$="D"THEN4110
4105 PRINT:PRINTTAB(13)"TURN OFF TAPE"
4106 IFPEEK(192)<>0THEN4106
4110 PRINT:GOSUB9500:RETURN
5000 REM *********ADD PLAYERS (OR START YEAR) *********
     *
```

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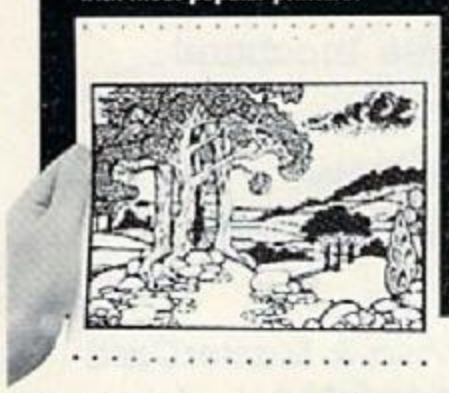

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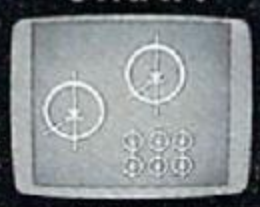
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batting averages are computed in the subroutine at lines 2500–2600. The formula is, as most of you know, Batting Average equals Hits divided by At Bats. Also, this routine rounds off the averages to three decimal places and adds following zeroes to averages that come out even in the hundredths or thousandths columns, so that the decimal points are justified in the printout.

Lines 3000–3180—sort and display stats. In line 3005, we check to see if data has been added. Remember, the previous totals are stored in array A(x,y), while if new data has been added, the new totals are stored in array B(x,y). This section is written to sort array B(x,y), so if we want to load the previous data and go directly here to sort it, we must transfer it from array A(x,y) to array B(x,y). This is accomplished in subroutine 2170, and flag AD is set. If you sort data just loaded, you can still add new data and sort again, as array A(x,y) remains intact. Lines 3010–3150 sort the data, and lines 3160–3170 display the sorted information.

Lines 4000–4110—save new totals.

Lines 5000–5100—add players. This routine is used at the start of a season to set up a file of players' names or during the season to add new team members. As each name is entered, that player's totals are set to zero.

Lines 6000–6099—team totals. These totals are stored in array M(x) and are determined by adding the individual stats in array C(x,y), which is where we put the appropriate numbers in any routine before calling this subroutine. (See subroutine 8800 and lines 1192–1196.) Array M(x) is set to zero at the start of the routine, as this subroutine can be called more than once during a given run.

Lines 6100–6160—print team totals.

Lines 7000–7100—error correction. This routine is called from the data input routine, if input errors occurred.

Lines 8000–8090—print stats to screen.

Lines 8200–8410—stats to printer. Line 8210 serves the same function as line 3005, explained above. I used decimal tabulation in the printer routine so that the columns of figures would be right-justified. If your printer doesn't support decimal tabbing, change line 8235 to your Set Tab command. Line 8270 sets decimal tabs at the current printhead position. If your printer requires another method of setting tabs, you must make a change here. CHR$(9) sends the printhead to the next tab location. CHR$(10) is a line feed.

Lines 8500–8570—input subroutine. This subroutine is called from the error correction routine as well as from the standard input routine.

Lines 8800–8840—set C(x,y) before figuring team totals, as discussed above.

The remaining subroutines are fairly straightforward and should be self-explanatory.

Good luck to you in using Softball Stats, and to your team this summer and in summers to come. R

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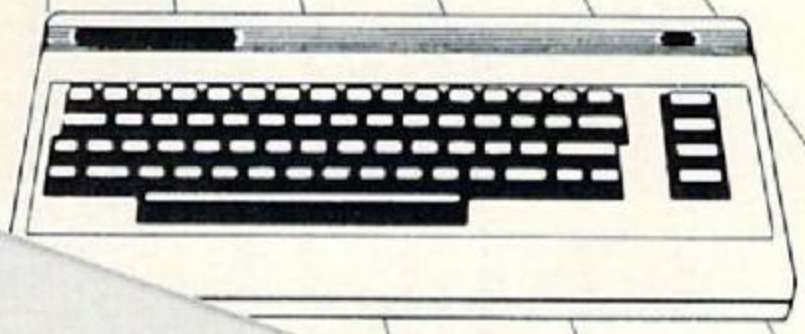

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Listing continued.

```
5010 PRINTCHR$(147):PRINT:PRINT"{4 SPACEs}ENTER 'END' A
     FTER LAST PLAYER":PRINT
5020 NP=NP+1
5030 INPUT"NAME";N$(NP)
5035 IFLEN(N$(NP))>8THENN$(NP)=LEFT$(N$(NP),8)
5040 IFN$(NP)="END"THENNP=NP-1:GOTO5100
5050 FORJ=1TO6
5060 A(NP,J)=0
5070 NEXT
5080 B$(NP)=" .000"
5090 PRINT:GOTO5020
5100 RETURN
6000 REM ************ TEAM TOTALS (M) **************
6010 FORI=1TO5:M(I)=0:NEXT:PRINT
6020 FORJ=1TO5
6030 FORI=1TONP
6040 M(J)=M(J)+C(I,J)
6050 NEXT
6060 NEXT
6070 IFM(1)=0THENM(6)=0:GOTO6093
6080 M(6)=M(2)/M(1)
6090 M(6)=INT(M(6)*1000+.5)/1000
6092 IFM(6)=1THENM$="1.000":GOTO6099
6093 IFM(6)=0THENM$=" .000":GOTO6099
6095 M$=STR$(M(6)):L=LEN(M$)
6097 IFL=3THENM$=M$+"00":GOTO6099
6098 IFL=4THENM$=M$+"0"
6099 RETURN
6100 X=8
6110 PRINT"TOTALS";
6120 FORJ=1TO5
6130 PRINTTAB(X)M(J);
6140 X=X+5
6150 NEXT
6155 PRINTTAB(X)M$
6160 RETURN
7000 REM ************ ERROR CORRECTION ************
7010 PRINTCHR$(147):PRINT:PRINTTAB(12)"ERROR CORRECTION
     ":PRINT:PRINT
7020 PF=0:INPUT"NAME OF PLAYER";C$:PRINT
7030 FORI=1TONP
7040 IFC$<>N$(I)THEN7060
7050 PF=1:GOSUB8500
7060 NEXTI
7065 IFPF=0THENPRINT"PLAYER NOT FOUND, TRY AGAIN":PRINT
     :GOTO7020
7070 PRINT:INPUT"MORE CORRECTIONS (Y/N)";MC$
7080 IFMC$="N"THENRETURN
7090 IFMC$="Y"THEN7010
7100 GOTO7070
8000 REM ********** PRINT STATS (SCREEN) ***********
8010 FORI=1TONP
8020 PRINTN$(I);
8030 X=8
8040 FORJ=1TO5
8050 PRINTTAB(X)B(I,J);
8060 X=X+5
8070 NEXT
8072 PRINTTAB(X)B$(I)
8080 NEXT
8090 RETURN
8200 REM ************ STATS TO PRINTER ************
8210 IFAD=0THENAD=1:GOSUB2170
8215 PRINTCHR$(147):INPUT"STATS THROUGH GAME #";GN
8220 PRINT:PRINT"{3 SPACEs}TURN PRINTER ON, SET PITCH,
     MARGINS"
8225 PRINT:PRINT"AND LINE SPACING.":PRINT:PRINT
8230 GOSUB9500
8235 DT$=CHR$(27)+CHR$(9):REM SET DECIMAL TAB
8240 OPEN4,4:CMD4
8245 PRINT"SOFTBALL STATS THROUGH GAME #";GN
8250 PRINTCHR$(27)CHR$(50):REM CLEAR TABS
8260 PRINT"NAME"SPC(8)"AB"SPC(6)"H"SPC(6)"R"SPC(6)"RBI"
     SPC(5)"BB"SPC(8)"AVG"
8270 PRINTTAB(15)DT$;SPC(7)DT$;SPC(7)DT$;SPC(8)DT$;SPC(
     8)DT$;SPC(6)DT$
8280 FORI=1TONP
8290 PRINTN$(I);
8300 FORJ=1TO5
8310 PRINTCHR$(9);B(I,J);
8320 NEXTJ
8330 PRINTCHR$(9);B$(I)
8340 NEXTI
8350 PRINTCHR$(10):PRINT"TOTALS";
8360 FORJ=1TO5
8370 PRINTCHR$(9)M(J);
8380 NEXT
8390 PRINTCHR$(9)M$
8400 PRINT#4:CLOSE4
8410 RETURN
8500 REM ************** INPUT STATS **************
8510 INPUT"ABS";B(I,1)
8520 INPUT"HITS";B(I,2)
8530 INPUT"RUNS";B(I,3)
8540 INPUT"RBIS";B(I,4)
8550 INPUT"WALKS";B(I,5)
8570 RETURN
8800 REM ****** SET C(X,X) BEFORE TOTALS******
8810 FORI=1TONP:FORJ=1TO5
8820 C(I,J)=B(I,J)
```

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Listing continued.

```
 8830 NEXT:NEXT
 8840 RETURN
 9000 REM ********************* SORT MENU **********************
 9010 PRINTCHR$(147):PRINT:PRINT "WHICH CATEGORY DO YOU
      WANT TO SORT BY?"
 9020 PRINT
 9030 PRINT:PRINT"{6 SPACEs}1{3 SPACEs}AT BATS"
 9040 PRINT:PRINT"{6 SPACEs}2{3 SPACEs}HITS"
 9050 PRINT:PRINT"{6 SPACEs}3{3 SPACEs}RUNS"
 9060 PRINT:PRINT"{6 SPACEs}4{3 SPACEs}RBIS"
 9070 PRINT:PRINT"{6 SPACEs}5{3 SPACEs}WALKS"
 9080 PRINT:PRINT"{6 SPACEs}6{3 SPACEs}AVERAGE"
 9090 PRINT:PRINT:PRINT
 9100 INPUT"{3 SPACEs}ENTER YOUR CHOICE";S
 9110 IFS<1ORS>6THEN9100
 9120 RETURN
 9500 REM ********************* GET KEY **********************
 9510 PRINT:PRINTAB(15)"HIT A KEY"
 9520 GETK$:IFK$=""THEN9520
 9530 RETURN
 9800 REM *** GET TAPE OR DISK INPUT ***
 9810 INPUT"TAPE OR DISK (T/D)";TD$
 9820 IFTD$<>"D"ANDTD$<>"T"THEN9810
 9840 PRINT:INPUT"STATS THROUGH GAME NUMBER";GN$:GA=VAL(
      GN$)
 9850 RETURN
10000 REM ********************* PRINT HEADINGS **********************
10010 PRINT"NAME";TAB(9)"AB";TAB(14)"H";TAB(19)"R";TAB(
      23)"RBI";TAB(29)"BB";
10020 PRINTTAB(35)"AVG"
10030 RETURN
11000 PRINTCHR$(147):END:REM ******* QUIT *******
```

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Quick Change Artist

Changing screen, border and character colors on your C-64 doesn't have to be a cumbersome process. This program lets you switch colors in a jiffy using just the Commodore and function keys.

By Bruce Jaeger

One of the nicest features of the Commodore 64 is the variety of colors available; but the computer's Basic interpreter doesn't make it particularly easy to use those 16 colors.

On startup, the display consists of light-blue letters on a dark-blue background, a combination barely readable on a decent monitor, let alone the more common television set. To change the border and background colors, you have to Poke 53280 with a number from 0 to 15 for the border, and Poke 53281 for the screen.

Here's a brief machine language program that makes it all easy. Load and run Color Minder, and your border, screen and character colors can be changed with the push of a key—either during a program or in Direct (programming) mode!

To use Color Minder, carefully type in the program from the printed listing, and save it before running. (It's prudent to save *every* program you type in before running it, especially machine language programs. A slight typing mistake could "lock up" the computer, forcing you to retype an entire program.)

Now run Color Minder. In a second or so the Ready prompt will flash on the screen. The program has loaded itself into memory, starting at $C350 (decimal 50000), and has redirected the interrupt vectors to point to itself.

Now hold down the Commodore key (on the bottom row, far left). Press function key f1, and the border changes color. Press function key f3, and the screen background changes. Function key f5 changes the color of all the characters on the screen. And function key f7 turns off Color Minder. (To reenable it, just type SYS 50000 and press the return key.)

I chose the combination of the Commodore and function keys because of the relative unlikelihood of these keys being used together in a program. Now it will always be easy for you to change those colors.

How the Program Works

Color Minder is an interrupt-driven program. Sixty times a second, Commodore's Basic interpreter takes time out from whatever it's doing at the moment to perform a lot of housekeeping chores, like updating the internal clock, looking for the stop key and so on.

There are two pointers at memory locations 788 and 789 (hexadecimal $0314 and $0315) that tell the computer where to go for this housekeeping routine. You can change those pointers to have them point at your own program.

Look at the first part of the assembly listing, entitled Change Interrupt Vectors. This is a little program in itself that first turns off or disables all interrupts, so the computer doesn't get confused while you're changing your pointers. It then changes the pointers to point to the first step of your main program, in this case $C35D.

Note that the address $C35D is stored in memory "backwards," in what's called low-byte, high-byte format. $5D is stored in $0314, and $C3 in $0315. The CLI instruction then reenables the interrupts, and the RTS (return from subroutine) sends control back to Basic. Now, every 1/60th of a second, Basic jumps to your own program, starting at #C35D.

Main Program

First, you load the accumulator with the contents of SKEY, which contains the value of any shift, control or Commodore key pressed. Pressing the Commodore key puts a value of 2 in this address. The computer checks to see if there is, indeed, a 2 there. If not, you aren't pressing the Commodore key, and the program knows that it's not being called upon to do anything. So it

RUN It Right

Commodore 64

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branches to the Back subroutine with a BNE BACK (Branch if Not Equal to Back), which sends the computer to the rest of its housekeeping chores.

If the Commodore key *is* being pressed, then the accumulator is loaded with the contents of Key, which contains the value of any non-control type key being pressed. The program compares this value with FLAG, which contains the value of the *last* key Color Minder looked at; if it's the same, the program again branches to the Back routine. This is done to keep Color Minder from repeating itself at 60 color changes per second (pretty dizzying!). You have to let up on a key in between color changes.

If the Flag repeat test is passed, the first move is to store the new key value in FLAG with a STA FLAG instruction. (This will avoid repeats of your new key next time.) Then the key value is compared to 4, the value we get in location 197 when we push the F1 key. If there's a match, the program branches to BORCOL, the border color routine.

If the key doesn't match 4, it's compared in turn with 5 (the F3 key value), 6 (the F5 key) and 3 (the F7 key). If after all this you still don't have a match, the program exits through the Back command.

Color Subroutines

Both BORCOL (border color change) and SCNCOL (screen color change) are extremely simple. You just add 1 to the appropriate memory address of either the screen background color (53281) or the border color (53280), then jump to the Back routine.

CHARCO (character color) changes the color of the characters on the screen and is more involved; you have to do it individually, character by character.

CURCOL (decimal memory location 646) contains the current cursor color. First you increment CURCOL to get the new color, and load the accumulator with this number (LDA CURCOL).

The next part of the routine uses indirect indexed addressing to step through the entire Commodore 64 color RAM ($D800 to $DBE7). The beginning address of the color RAM is stored in low byte/high byte format in the zero page addresses $FC and $FD. (See any 6502 machine language programming book for an explanation of indirect indexed addressing.)

The program then loops through the four 256-byte pages of color RAM, storing the new color at each location. The X register keeps track of which

```
100 REM ******************
110 REM **                **
120 REM ** COLOR MINDER **
130 REM **  ----------    **
140 REM ** BRUCE JAEGER **
150 REM **                **
160 REM ******************
170 REM
180 REM
1000 REM POKE ROUTINE INTO MEMORY
1010 FOR J=50000 TO 50110
1020 READ K : POKE J,K
1030 NEXT J
1040 REM
1050 SYS 50000 : END
1060 REM
1070 REM
2000 DATA 120,169,93,141,20,3,169,195,141,21,3,88,96,17
     3,141,2
2010 DATA 201,2,208,70,165,197,205,188,195,240,63,141,1
     88,195,201,4
2020 DATA 240,15,201,5,240,17,201,6,240,19,201,3,240,47
     ,76,170
2030 DATA 195,238,32,208,76,170,195,238,33,208,76,170,1
     95,238,134,2
2040 DATA 173,134,2,160,0,132,252,162,216,134,253,145,2
     52,200,208,251
2050 DATA 232,224,220,208,244,76,170,195,41,15,76,49,23
     4,120,169,49
2060 DATA 141,20,3,169,234,141,21,3,88,76,170,195,3,177
     ,95
```

Listing 1. Color Minder program for the C-64.

Listing 2. Assembly listing for Color Minder.

```
0001  0000             ; ************************
0002  0000             ; COLOR MINDER SOURCE CODE
0003  0000             ; ************************
0005  0000             ; DEFINE ADDRESSES
0006  0000             ; ************************
0007  0000             SKEY   = 653            ; SHIFT (CONTROL) KEYS
0008  0000             KEY    = 197            ; CURRENT KEY PRESSED
0009  0000             CURCOL = 646            ; CURRENT CURSOR COLOR
0010  0000             COLOR  =55296           ; COLOR RAM
0011  0000             BORDER=53280            ; BORDER
0012  0000             BKGRND=53281            ; BACKGROUND
0014  0000             ; CHANGE INTERRUPT VECTORS
0015  0000             ; ************************
0016  0000                   *=50000           ; BEGIN ASSEMBLY HERE (#C350)
0017  C350  78              SEI               ; DISABLE INTERRUPTS
0018  C351  A9 5D          LDA #<PRGAM       ; REDIRECT INTERRUPT VECTORS
0019  C353  8D 14 03       STA $0314         ; TO POINT AT PROGRAM
0020  C356  A9 C3          LDA #>PRGAM
0021  C358  8D 15 03       STA $0315
0022  C35B  58              CLI               ; REENABLE INTERRUPTS
0023  C35C  60              RTS               ; BACK TO BASIC
0025  C35D             ; COLOR MINDER PROGRAM
0026  C35D             ; ************************
0027  C35D  AD 8D 02   PRGAM  LDA SKEY         ; GET SH/CON KEYS
0028  C360  C9 02            CMP #2            ; COMMODORE KEY PRESSED?
0029  C362  D0 44            BNE BACK          ; NO--EXIT
0030  C364  A5 C5            LDA KEY           ; GET CURRENT KEY PRESSED
0031  C366  CD BA C3         CMP FLAG          ; SAME AS LAST TIME?
0032  C369  F0 3D            BEQ BACK          ; YES--EXIT (AVOIDS DIZZY
0033  C36B                                    ; ; COLOR CHANGES)
0034  C36B  8D BA C3         STA FLAG          ; REMEMBER FOR NEXT TIME
0035  C36E  C9 04            CMP #4            ; F1 KEY?
0036  C370  F0 0F            BEQ BORCOL        ; YES--GOTO BORDER ROUTINE
0037  C372  C9 05            CMP #5            ; F3 KEY?
0038  C374  F0 11            BEQ SCNCOL        ; YES--GOTO SCREEN ROUTINE
0039  C376  C9 06            CMP #6            ; F5 KEY?
0040  C378  F0 13            BEQ CHARCO        ; YES--GOTO CHARACTER ROUTING
0041  C37A  C9 03            CMP #3            ; F7 KEY?
0042  C37C  F0 2D            BEQ RESET         ; YES--GOTO RESET ROUTINE
0043  C37E  4C A8 C3         JMP BACK
0045  C381             ; COLOR SUBROUTINES
0046  C381             ; ************************
0048  C381             BORCOL                  ; BORDER COLOR ROUTINE
0049  C381             ; ************************
0050  C381  EE 20 D0         INC BORDER        ; CHANGE BORDER
0051  C384  4C A8 C3         JMP BACK          ; EXIT
0053  C387             SCNCOL                  ; SCREEN COLOR ROUTINE
```

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page the routine's on; when $DC is reached, it's done and jumps to the Back routine.

Kill Color Minder

You must disable Color Minder before any other data or programs can be

> *It's prudent to save every program you type in before running it.*

Poked or read into its area. If not, the interrupt vectors will faithfully send the computer to that address, and if you're in the process of putting something *else* in there, ZAP! Instant crash. Color Minder should also be killed before using the cassette drive. (To reenable, just type SYS 50000.) This routine is just the opposite of the original set-up routine; the interrupts are disabled, and the interrupt pointers are loaded with their normal contents, pointing to address $EA31. R

Listing 2 continued.

```
0054  C387                ; *************************
0055  C387  EE 21 D0             INC BKGRND      ; CHANGE BACKGROUND
0056  C38A  4C A8 C3           JMP BACK        ; EXIT
0058  C38D                CHARCO                ; CHARACTER COLOR ROUTINE
0059  C38D                ; *************************
0060  C38D  EE 86 02           INC CURCOL      ; CHANGE COLOR UNDER CURSOR
0061  C390  AD 86 02           LDA CURCOL      ; GET NEW CHAR COLOR
0062  C393  A0 00              LDY #00         ; ZERO Y INDEX
0063  C395  84 FC              STY $FC
0064  C397  A2 D8              LDX ##D8        ; COLOR RAM HIGH BYTE
0065  C399  86 FD       LOOP   STX $FD         ; SAVE AT $FD
0066  C39B  91 FC       INLOOP STA ($FC),Y     ; PUT NEW COLOR ON SCREEN
0067  C39D  C8                 INY             ; INCREMENT Y INDEX
0068  C39E  D0 FB              BNE INLOOP      ; IF Y<>0 (OR 256) THEN REPEAT
0069  C3A0  E8                 INX             ; INCREMENT X (HIGH BYTE)
0070  C3A1  E0 DC              CPX ##DC        ; X=$DC (MEANING WE'RE PAST THE
0071  C3A3                ; ; COLOR RAM AREA?)
0072  C3A3  D0 F4              BNE LOOP        ; NO...REPEAT FOR ANOTHER 256
0073  C3A5  4C A8 C3           JMP BACK        ; YES...WE'RE DONE, EXIT
0075  C3A8                ; CONTINUE NORMAL INT. ROUTINE
0076  C3A8                ; *************************
0077  C3A8  4C 31 EA     BACK   JMP $EA31
0079  C3AB                ; KILL COLOR MINDER
0080  C3AB                ; *************************
0081  C3AB  78           RESET  SEI             ; DISABLE INTERRUPTS
0082  C3AC  A9 31              LDA ##31        ; REDIRECT VECTORS
0083  C3AE  8D 14 03           STA $0314       ; TO ORIGINAL ADDRESS ($EA31)
0084  C3B1  A9 EA              LDA ##EA
0085  C3B3  8D 15 03           STA $0315
0086  C3B6  58                 CLI             ; REENABLE INTERRUPTS
0087  C3B7  4C A8 C3           JMP BACK
0089  C3BA                ; *************************
0090  C3BA                FLAG   *=*+1           ; STORE REPEAT FLAG HERE
0091  C3BB                       .END

ERRORS = 0000

SYMBOL TABLE

SYMBOL VALUE
 BACK     C3A8    BKGRND   D021    BORCOL   C381    BORDER   D020
 CHARCO   C38D    COLOR    D800    CURCOL   0286    FLAG     C3BA
 INLOOP   C39B    KEY      00C5    LOOP     C399    PRGAM    C35D
 RESET    C3AB    SCNCOL   C387    SKEY     028D
END OF ASSEMBLY
```

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Radio-Active

If you're both a radio ham and a computer enthusiast, this article shows many ways you can blend the two hobbies by using amateur radio software designed for the VIC-20 or C-64.

By Karl T. Thurber, Jr.

There are few hobbies that go together as well as amateur radio and personal computing. Computers can perform powerful tricks and special tasks in the hamshack, to make an already enjoyable hobby more fun, relaxing and productive. 1984 may well be the year the computerized hamshack takes off in a big way.

The VIC-20 and Commodore 64 computers are naturals for many specialized ham applications, both the technical, horizon-expanding types, and those that reduce day-to-day hamshack drudgery.

You can use your computer for routine and fast-paced contest logging and duplicate contact crosschecking; Morse code (CW) and radioteletype (RTTY) communications; code practice and instruction; antenna design and directional antenna aiming; propagation prediction; tracking hobby accomplishments, magazine articles and construction projects; radio club newsletter production and mailing; and a host of other tasks.

Once you become skilled in programming, you'll likely want to write your own programs for your VIC or 64. But first, to give you an idea of what ready-to-run software is available now, I've corralled the products of more than 40 hamshack software sources and present them as a point of departure for your own investigating.

In this article, I'll review some of the major hamshack uses of computers and provide you with a list of the software sources mentioned above, including the mailing address of each firm or individual. In addition, for some of the instances where I've had some hands-on experience with a particular product, I'll show a sample program printout or a video-screen photo of the program in action.

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Software

There are a few points it's well to bear in mind. First, amateur radio software is still largely in the "cottage industry" stage, so the quality of the products offered varies widely. Much of the software I've examined is written by hams for hams, and is only semi-commercial.

But most ham software authors are conscientious programmers, and aim to produce a satisfying and useful product as well as turn a profit. In fact, most hamshack software results from an individual writing a program or series of programs for his own personal use, and then being encouraged by friends and acquaintances to offer his programs commercially.

Second, while my emphasis is on ham software, much of what I describe will be equally applicable to shortwave listeners (SWLs), broadcast band DXers, scanner-band monitors and others who share a common interest in radio transmission and reception. SWLs and scanner monitors keep logs, and many enjoy tuning the shortwave bands for interesting RTTY and CW signals. And almost any high-frequency (HF) band listener is interested in knowing what radio conditions are going to be like.

Third, my primary emphasis is on relatively inexpensive software, rather than on expensive hardware or software-hardware combinations such as full-blown computer/transceiver interfaces. It would take a separate article to do justice to this aspect of hamshack computing!

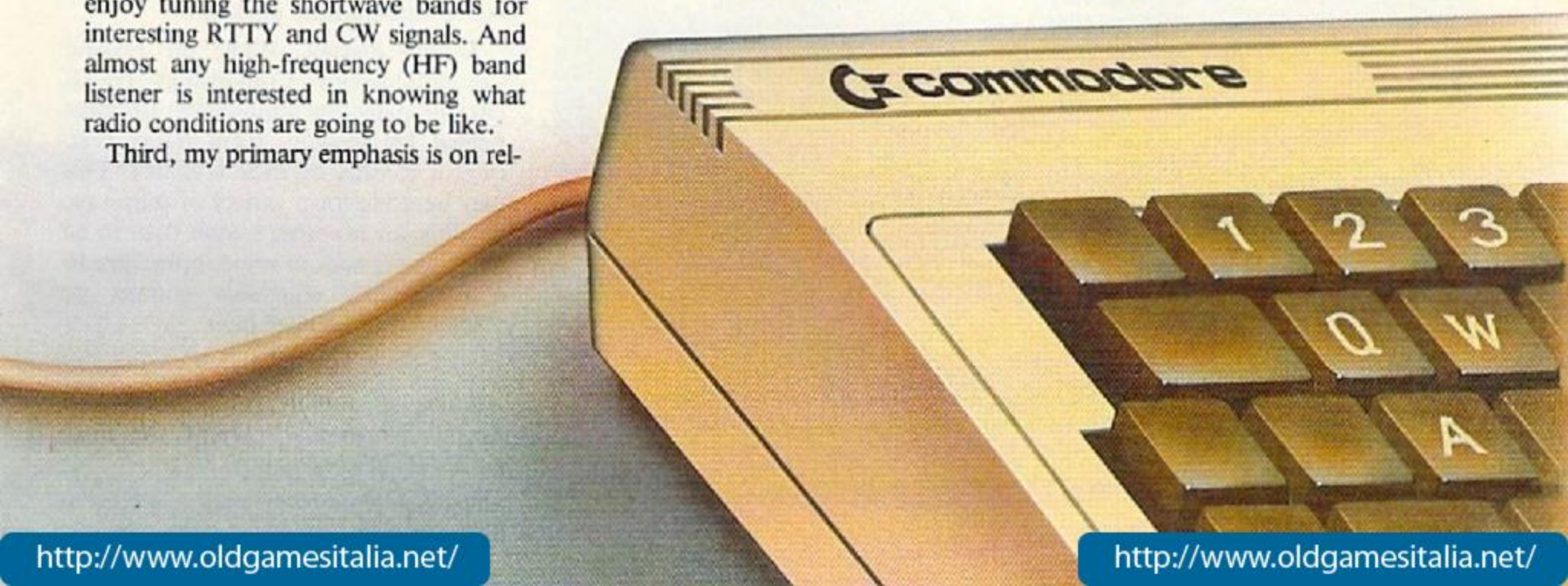
A Baker's Dozen for the Hamshack

I've already mentioned a few general hamshack applications for computers. Now let's examine in some detail a few real, live applications for the VIC and 64 in your station.

Propagation prediction. Extremely important to efficient station operation is predicting whether or not radio conditions will be good enough for signals to reach (or be heard from) various areas of the world at a given time of day on a certain date. Using a personal computer, radio amateurs and SWLs can produce timely predictions of high frequency "skywave" openings between any two points on the globe.

Practically all propagation-prediction programs use an ionospheric model based on a program developed by the Navy for field use by the armed forces. Using just a few easily obtainable tidbits of essential information (the "solar flux" figure, available hourly over the air from the National Bureau of Standards station WWV, your own geographical coordinates and the coordinates of the distant point), these programs produce a nicely formatted video or printer output of 24 hourly predictions of the maximum usable frequency (MUF) over the path.

Some of these programs are barebones, but others do fancy things, such as showing an estimate of the *lowest* usable frequency (LUF) over a given path; calculating the distance to the target area or point in kilometers or miles; giving sunrise and sunset times; and providing rotary-beam antenna-heading information. These programs are also useful learning tools, for you can exper-



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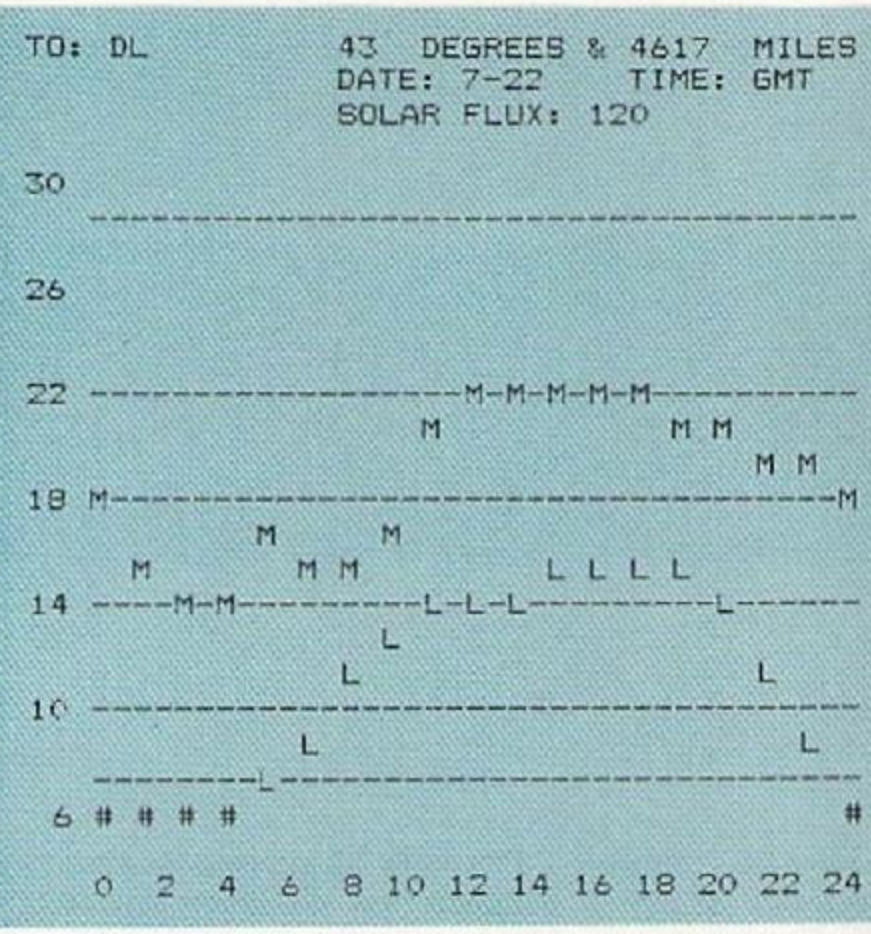

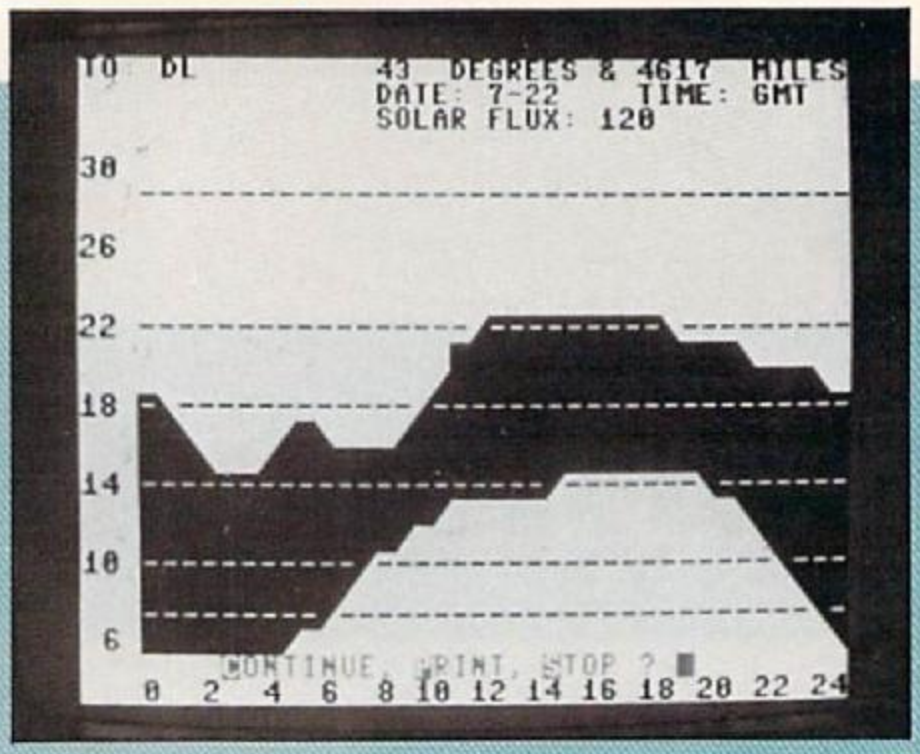

Fig. 1. Printout and screenshot of C-64 MUFPLOT program from Base 2 Systems, showing Maximum and Lowest Usable Frequencies (MUF and LUF) over a directional path from Alabama to Germany.

iment with the data to see what happens to propagation under various conditions and over various paths. At least one program, Base 2 Systems' MUFPLOT, allows you to scan the world to see at a glance which areas are likely to be active at a given time.

Pointing your beam. Either as part of a propagation program or as a stand-alone routine, it's fairly easy to point your rotary-beam antenna in exactly the right direction using a global-heading calculating program. Most such programs have you enter the latitude and longitude of the station you want to communicate with, as well as your own coordinates. They will then output the desired beam heading, short path or long path (over the pole) distances and sometimes other useful information, such as time-zone difference data.

The fancier programs include a large built-in database of country and/or callsign prefix information, so that the need to enter actual geographical coordinates is eliminated. These programs are frequently available already customized for your own location. The same geographical database can be used in both propagation and beam-heading programs, so the two types are frequently combined and offered as a versatile, dual-purpose package.

Station logging. While the Federal Communications Commission (FCC) has eliminated the requirement for most formal log-keeping, most hams keep careful records of their contacts. This may be done for a variety of purposes, possibly for no other reason than to be able to refer back at some future date to a particularly enjoyable contact or "QSO" with another ham.

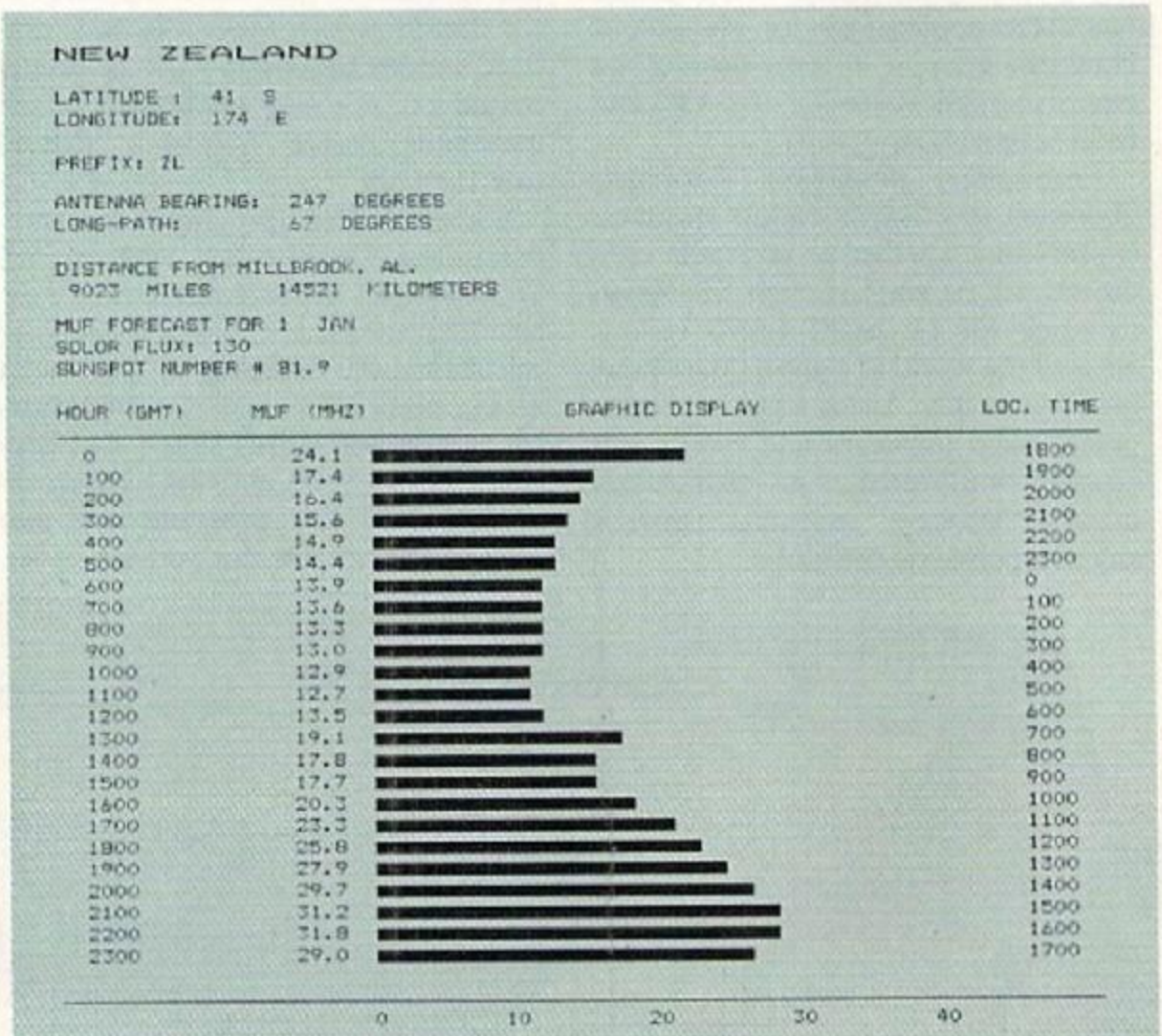

Fig. 2. Printout of another propagation prediction program by Eugene Morgan, featuring a graphic display of MUF on a path from Alabama to New Zealand.

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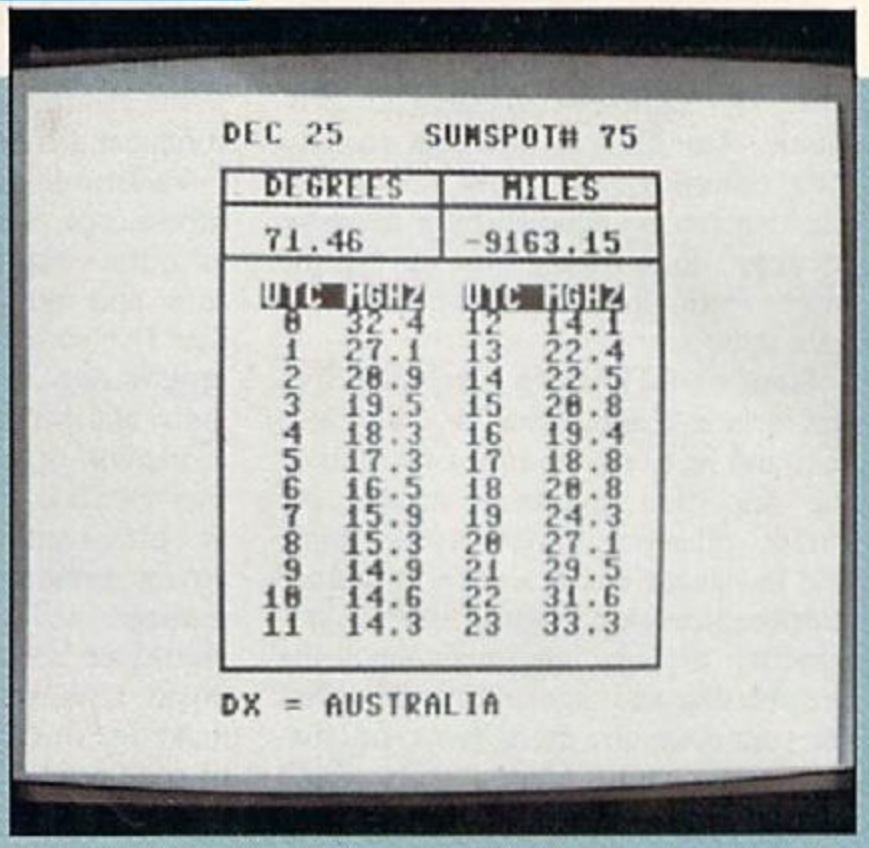
```
DATE: 01 JAN
10.7-CM FLUX: 160          SUNSPOT NR: 115
FM: MONTGOMERY AL           32-20N 086-20W
TO: NORWAY                  71-00N 024-00E
DISTANCE: 7324 KM = 4551 MI = 3954 NM
BEARING: 020
     UT      MUF          UT      MUF
   0000     10.6         1200     16.8
   0100     10.4         1300     18.7
   0200     10.3         1400     19.1
   0300     10.2         1500     19.1
   0400     10.2         1600     18.7
   0500     10.1         1700     17.7
   0600     10.1         1800     16.0
   0700     10.0         1900     12.1
   0800     10.0         2000     11.7
   0900     10.0         2100     11.3
   1000     10.2         2200     11.0
   1100     10.1         2300     10.8
PRINT OR NEXT CASE?
```

The Procast program for the C-64 provides beam-heading data as well as fast and accurate propagation-path prediction.



Propagation Chart for the C-64 (from Ham Data Co.) gives optimum transmission frequency to a given point.

The real meat of logging, however, is in keeping track of contacts for the special county, state, country, world zone and continent awards that many hams seek. Computers lend themselves very nicely to such recordkeeping, and especially to fast retrieval of data by date and time of contact, frequency band, radio callsign, name, QTH (location) and so on. Most such programs are set up for convenient, real-time (on-the-air) data entry and so that no extra time is required to enter the log data, which can be stored on disk or cassette tape and printed out in hardcopy format later on.

A specialized form of logbook program is the contest logger. Many hams are avid contesters, and they usually must use a special type of log that's designed to properly record the on-the-air contest exchange of data, and later to present this data in a format that's easily scored by the contest sponsors.

Sophisticated, yet inexpensive, contest-logging programs are available that eliminate or at least largely reduce the drudgery of checking for no-credit duplicate contacts ("dupe checking"). Most of these programs also make use of the computer's calculating ability for scoring and summarizing contest performance. With a single keystroke, a ready-to-mail contest-log printout can be obtained.

A few logging and contesting programs also can generate QSL (confirmation) cards and mailing labels on command, using the basic logbook data already recorded. A push of a button, and a day's QSLing chores are taken care of, with the paper cards ready for mailing to a stateside or overseas QSL forwarding bureau or service.

This handy feature is a boon to high-volume ham operations, such as participation in a popular weekend contest or operating from a rare overseas location, where thousands of contacts may be made in just a few days. One software author has even written a complementary database program that will give addresses of, and print labels for, practically all of the world's QSL forwarding bureaus!

Of special interest to SWLs, the ANARC Computer Information Committee has a variety of inexpensive VIC-20 and Commodore 64 programs for the listener, mostly of a logging nature. These include basic logging, log sorting and station listing, daylight/darkness calculation, propagation and frequency-reception guide programs.

Keeping track of accomplishments. Hams are notorious award and certificate collectors. Attainment of the many hundreds of radio amateur awards is complicated by the fact that many are available with different frequency bands, power levels, modes of operation (voice or Morse code, for example) and other specialized criteria applying to them.

Many of the more powerful logging programs have features that allow a summary printout of your contacts by such specialized criteria. For example, it's possible to print out a band-by-band summary of your state, country or continent contact status, as well as a "how goes it?" summary of remaining accomplishments needed and a summary of the all-important QSL card verifications received from the stations contacted.

General-purpose recordkeeping. Most

FROM THE LOG OF KA9KUH

REPORT DATE 840129

DATE	UTC	CALL	NAME	QTH	FREQ	RST	MODE	QSO#
831028	2231	KA4GTF	TOM	FLA	21	599	CW	9
831028	0100	LU7DXT	MARIANO	B. AIRES	21	559	CW	10
831031	2032	KA4WTJ	BERT	FLA	21	599	CW	11
831030	2052	KA9LVQ	NORM	LA	21	539	CW	12
831031	2050	N6HPQ	ED	CA	21	579	CW	13
831031	2126	ZL2GH	BRYCE	NEW ZEALAND	21	559	CW	14
831112	2126	N5GFX	CHAS	AUSTIN	21	339	CW	15

END OF REPORT

Fig. 3. A sample logbook page as printed out from the LOG & QSL program for the C-64 by Harvey Nelson, KA9KUH.

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hams keep records and lists of one sort or another, and these lend themselves well to database-management programs. Any kind of task that requires data collecting, sorting, searching and tracking can be handled by a database program, thus freeing you up for the more creative and productive aspects of ham radio.

Some useful in-shack database activities include keeping track of QSL cards sent and received; recording and indexing important magazine articles for future reference; inventorying home and hamshack equipment for insurance purposes; developing parts lists for construction projects; and maintaining the membership and newsletter mailing lists for your computer users' group or amateur radio club. Undoubtedly you'll think of a dozen more applications.

Of course, you should temper your computer enthusiasm with common sense. Some tasks are easier done by hand; if it takes you more time to convert a particular chore to computer operation than simply to do the task manually, then reconsider! File setup and maintenance can take a great deal of time, and if you're not willing or able to invest that time, then don't set up a computer file in the first place!

Morse code practice and instruction. To some people, learning Morse code is a necessary evil, but to others it's the lifeblood of amateur radio. To master the code, it's necessary to learn to associate the sound of a letter with the letter itself. It does little good to look at the code on paper and then try to memorize it as "dots and dashes." It's far better to learn each letter by its distinctive sound and rhythm. The use of a personal computer is a natural for this purpose.

Various approaches are evident in Morse code practice software, but most have the common thread of providing letter and sound association. Programs that I've seen include such features as progressively more difficult learning of individual Morse characters; automatic generation of random code groups at a user-specified speed; on-screen displays of quizzes and tests, much like popular typing programs; and user-definable messages and practice groups offering immediate feedback on performance. Some advanced disk-based programs make use of relative files for fast access of code-practice messages.

Computer-generated Morse code practice is vastly superior, at least for the beginner, to over-the-air code practice sessions. The latter are subject to interference and distracting static and noise. It's interesting, however, that at least one software author I know of is working on a Morse code tutoring program that will allow the introduction of simulated on-the-air conditions, such as QSB (fading), QRN (static) and QRM (interference) at various levels. This will provide challenging practice in copying under difficult conditions. Any way you cut it, there are probably more VICs and 64s out there helping beginners to become hams than any other personal computer. (For a Morse code tutoring program, see Morse Code Medley elsewhere in this issue–Ed.)

Antenna design and construction. Ham antennas are usually designed using a stubby pencil and a calculator. But it's possible to do your figuring on a computer, and this can be fun and instructive. There are programs that make it a simple matter to plan and calculate the correct dimensions and wire sizes for various types of antennas, such as dipoles, quads, Yagis, inverted Vees and verticals.

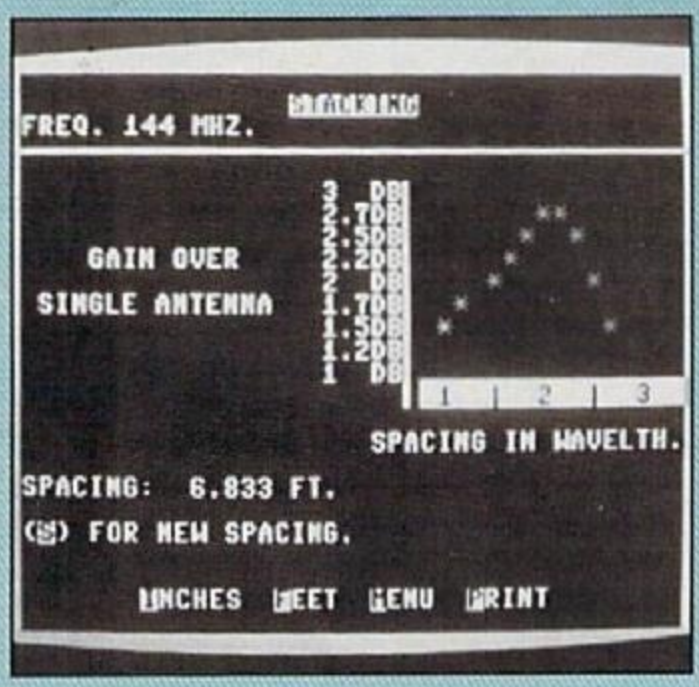
Some of the more sophisticated programs also include construction data for log periodics, phased verticals and even stacking harnesses. At least one program I know of, WB7RLX's Antenna Design, helps you determine antenna performance, including effective radiated power (ERP) and predicted gain data, and it also includes a handy command to convert back and forth between inches and feet in presenting the antenna's dimensions.

While you may not build enough antennas to justify the purchase even of an inexpensive antenna-design program, such programs offer the intrepid experimenter some nice "what if" possibilities, much akin to the "what ifs" offered by some electronic spreadsheets and databases. Such programs provide answers to questions that you might never bother to work out in the old-fashioned way.

Electronic calculation. Hams who are active equipment builders make use of a wide variety of radio formulas in their day-to-day calculations. The VIC and 64 can easily be programmed to handle the most commonly-used for-

```
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *

     KA9KUH     KA9KUH     KA9KUH

                  HARV NELSON
       P.O.BOX 736  STEVENS POINT, WISCONSIN 54481

CONFIRMING CW QSO WITH:                        QSO # 10
-------------------------------------------------------
STATION        YYMMDD       UTC       FREQ        RST
-------------------------------------------------------
LU7DXT         831028       0100      21          559
-------------------------------------------------------
RIG:TS830S/150WATTS  ANT:TH5DX AT 65 FT. & DIPOLES
COMPUTER:COMMODORE 64,KANTRONICS SFTWR,AEA PATCH

MARIANO. TNX FER FB QSO                        73.

* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Fig. 4. This QSL (confirmation) card was generated using information from the logbook shown in Fig. 3.



Antenna Design (RAK Electronics) provides graphic displays as well as practical information for the antenna builder.

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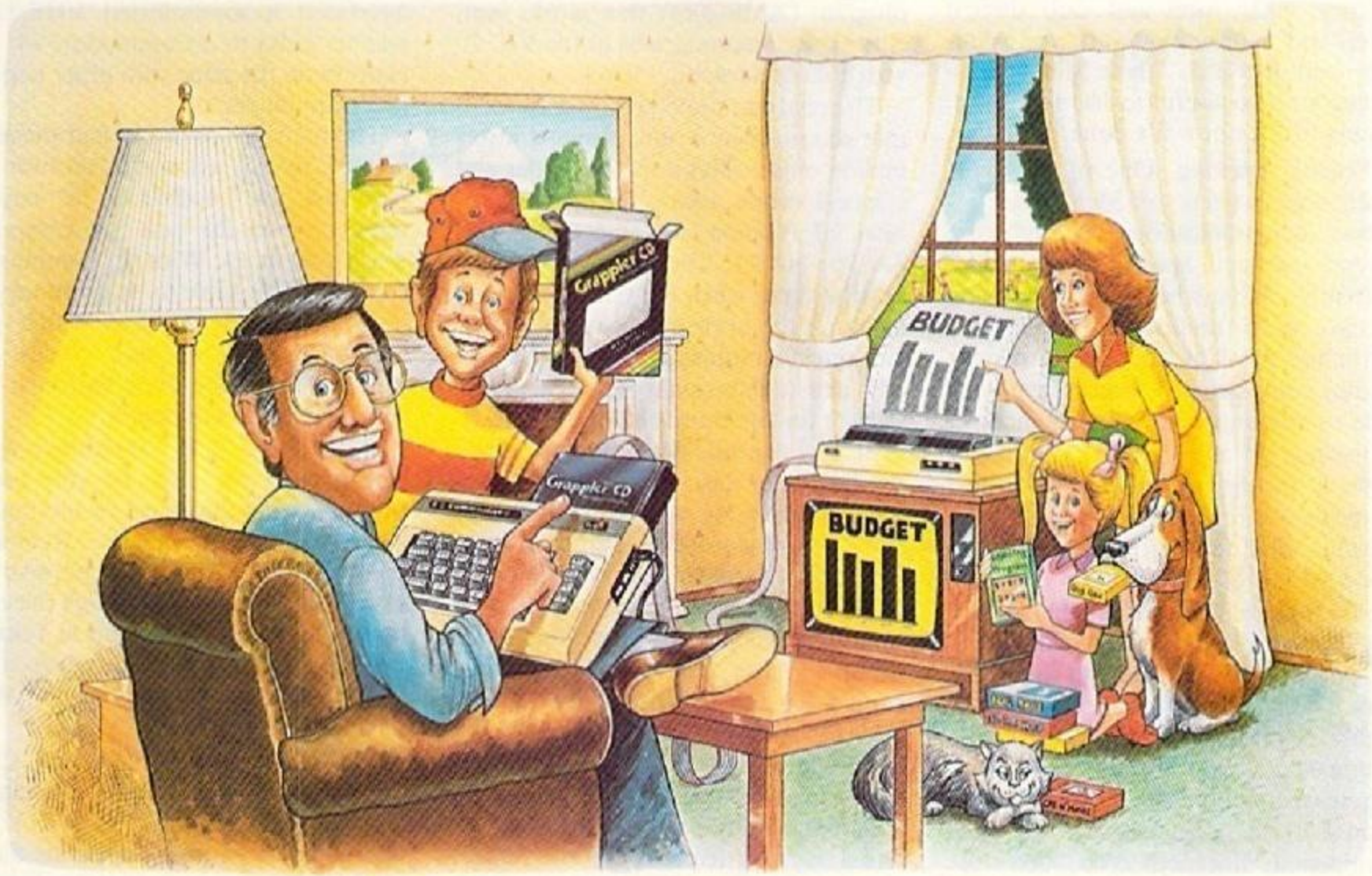

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Circle 195 on Reader Service card.

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mulae. Simple, menu-driven programs are available (several in the public domain) that make short work of calculations involving Ohm's Law; power supply design; series and parallel resistor or capacitor combinations; resonant frequency; filter, trap and stub design; series and parallel inductors; coil winding; and the like. These simple programs are also useful as learning tools, simply to "see how it's done."

Satellite tracking. One of the most fascinating aspects of ham radio involves communications through the several amateur-sponsored satellites currently circling the globe. Beginning in 1961, when the first Phase I OSCAR (Orbiting Satellite Carrying Amateur Radio) was launched, hams have been able to communicate over distances of thousands of miles using VHF (very high frequency) and UHF (ultra high frequency)—frequencies previously considered useful mostly for relatively short, line-of-sight distances.

A new era was inaugurated in the summer of 1983, when the first Phase III satellite, OSCAR 10, was launched. This satellite is distinctive in that its highly elliptical orbit allows properly-equipped hams in the northern hemisphere to communicate reliably through it on a 10- to 12-hour basis, over intercontinental distances. To best use satellites such as OSCAR 10, however, it's necessary to locate them precisely and determine the times when they're within range. You can do this either by using a mechanical tracking aid or with a computer.

Several programs are available that achieve simple and rapid positioning. For example, the nonprofit Amateur Satellite Corporation (AMSAT)—the organization that's at the center of amateur satellite design, development and construction—offers an inexpensive program (AMS-2064) that works with either the Commodore 64 or the VIC-20 with 16K expansion.

The program provides you with accurate access-schedule and tracking information on satellites in both circular and elliptical orbits, using "Keplerian" orbital information available from AMSAT or NASA. The program will output the times when a given satellite will be above the horizon and will also provide timed coordinates so you can properly aim a directional antenna at the satellite for optimum communications.

Station control. We've just scratched the surface in this area, but some hams are experimenting with computer control of their hamshacks, particularly for the "smart" control of various transmitter or transceiver functions.

At least one manufacturer, the Heath Company, has produced a computer-compatible HF transceiver, the Model SS-9000. At the heart of this transceiver is an "intelligent" control circuit that assists a serial interface in maintaining communications protocol between external operator requests and the various internal circuits in the transceiver. The controller allows two-way communication between a video terminal, hard-copy ASCII teletypewriter or computer.

While the Heath H-89 computer is the one the company had in mind to interface with the new transceiver, connecting the unit to a Commodore 64 via the user I/O port appears to be a possibility worth investigating.

Interfacing computers to external radio equipment is becoming almost routine. For example, Bearcat Electra has interfaced a sophisticated VHF/UHF scanner radio to a Commodore 64, and plans to do the same with other popular microcomputers.

The marriage of the 64 and the scanner radio yields a scanning receiver system that has capabilities far beyond those of even the best non-computer-assisted scanners. With the computer in control, it's possible to program very intricate bandscanning and search patterns with lots of nice "bells and whistles" to make even the most discerning scanner nut happy.

RTTY and CW communications. These represent two of the breakthrough areas that have revolutionized amateur communications. Radioteletype, or RTTY, has been popular for many years with hams, though the cumbersome and noisy mechanical Teletype units have largely been replaced by silent computers and winking video screens.

The inexpensive VIC-20 and Commodore 64 are particularly popular as the heart of computerized RTTY setups. The only extras you need are an appropriate software program and an interface or terminal unit between the computer and the receiver and transmitter, or transceiver. Best of all, you don't need a detailed technical knowledge of computer operation to get up and running on RTTY.

AMSAT AMS-2064 TRACKING PROGRAM
W8FX SCHEDULE: 14129 FROM: 29NOV83 193020

DATE	AOS	LOS	MAX	LOS DATE	DX/EL		AZ
29NOV83	1413	0101	1930	30NOV83	11040		198
30NOV83	1329	0017	1849	01DEC83	11012		163
01DEC83	1245	2332	1808	01DEC83	11534		136
02DEC83	1202	2247	1727	02DEC83	12333		119
03DEC83	1119	2201	1646	03DEC83	13221		108
04DEC83	1038	2114	1605	04DEC83	14115		100
05DEC83	1001	2028	1524	05DEC83	14974		94
06DEC83	1055	1938	1443	06DEC83	15778		89
07DEC83	1123	1847	1402	07DEC83	16518		84
08DEC83	1153	1754	1322	08DEC83	17203		79
08DEC83	2241	2317	2317	08DEC83	17954	*	279
09DEC83	0607	0652	0607	09DEC83	14650	*	274
09DEC83	1217	1654	1241	09DEC83	17891		75
09DEC83	2028	0142	0020	10DEC83	17704		284
10DEC83	0438	0610	0438	10DEC83	16580	*	290
10DEC83	1304	1542	1304	10DEC83	18041	*	70
10DEC83	1920	0528	2339	11DEC83	17020		280
11DEC83	1824	0445	2258	12DEC83	16316		275
12DEC83	1732	0402	2217	13DEC83	15551		271
13DEC83	1642	0319	2136	14DEC83	14721		266

Fig. 5. Access schedule and tracking information from satellite tracking program for the C-64 and VIC-20.

AMS-2064, from Amateur Satellite Corp. (AMSAT), is a program for the VIC-20 and C-64 that helps hams locate and track the several amateur satellites now circling the globe. Shown here is the Keplerian data file on the AMSAT OSCAR 9 satellite.

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While there's tremendous variation in the complexity of available software and interfaces, most RTTY packages include such handy features as split-screen operation for receive and transmit, a built-in time clock, user-definable "canned" messages, various preset messages and a type-ahead buffer that allows you to continue typing while still listening to the other station's transmission.

Just coming into popularity, too, are related electronic mailbox RTTY options that allow you to keep in touch with other amateurs automatically, while your communications equipment is largely unattended. HF mailbox operation can be undependable, but the mailboxes are especially popular and practical on VHF, because you don't have to worry about erratic reception conditions—static, interference, fading and other annoyances—that plague the lower (HF) frequencies.

Another development that is just beginning to take off is AMTOR, or Amateur Teleprinting Over Radio. This is RTTY-like communications with a handshaking feature that suppresses errors caused by on-the-air noise and interference. HF mailbox operation using AMTOR makes good sense, especially since you know immediately that your message is being perfectly received.

AMTOR bulletin boards, similar to familiar landline bulletin boards, offer good promise, too; but widespread ham use of bulletin boards and other "exotica" awaits relaxation of FCC regulations for fully automatic, unattended

Amateur Radio Software Sources

Amateur Accessories
6 Harvest Court, RD 7
Flemington, NJ 08822

AMSAT Software Exchange
Box 27
Washington, DC 20044

ANARC Computer Information Committee
6700 153rd Lane N.W.
Anoka, MN 55303

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15 Windsor Drive
Atco, NJ 08004

Base 2 Systems
2534 Nebraska St.
Saginaw, MI 48601

Albert Coya, N4AL
1710 S.W. 83rd Court
Miami, FL 33155

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Springfield, IL 62708

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Woodbridge, VA 22192

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Englewood, OH 45322

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Hoodsport, WA 98548

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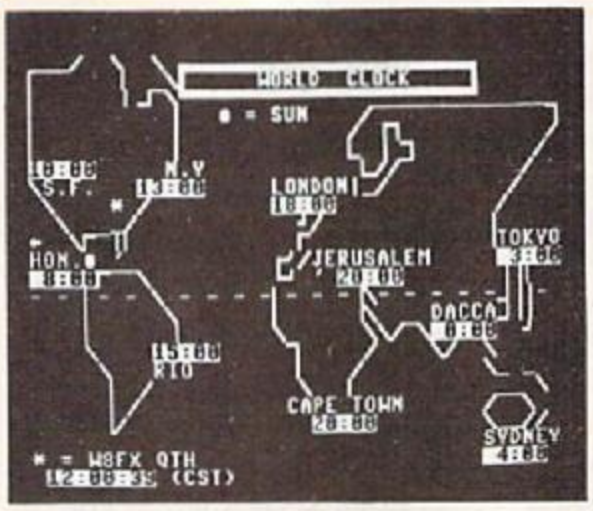

The World Clock program, available through the Toronto Pet Users Group and Public Domain, Inc., lets you see at a glance the correct time in various cities across the globe in terms of your own time zone.

operation. Hams who are also computer enthusiasts appreciate the fact that AMTOR's virtually error-free transmission offers the exciting possibility of accurate exchange of computer programs over the air.

Manual Morse has benefitted by the personal computer revolution, too; many stations now use keyboards rather than straight keys to exchange messages with one another. The features of computer-generated Morse code programs closely resemble those provided by RTTY software, though the cost of CW software for both the VIC and 64 is somewhat less than that for RTTY. Also, simpler interfaces are required for a CW-only setup.

Many hams report somewhat less satisfaction with computer-enhanced CW than with RTTY, however, for computer CW reception is heavily dependent upon the quality of the other operator's sending (if done manually), as well as on the absence of heavy interference.

Combining RTTY and CW in a single package is a natural development, and several such packages offer both modes together at modest prices. Several receive-only RTTY and CW packages are available, too, and these should interest SWLs, who need to know little or nothing about RTTY or Morse code to enjoy reception of stations transmitting in either mode.

I should mention some limitations. While the VIC-20 is extremely popular as a RTTY/CW keyboard, its 22-character line produces an awkward display that is tiring if you use it for very long. The 40-character line produced by the 64 is much more suitable for the purpose.

Also bear in mind that some typing skill on the standard QWERTY keyboard is necessary if you're to be reasonably efficient in on-the-air operation. Finally, using your computer for on-the-air RTTY or CW work of course precludes its simultaneous use for logging or other hamshack chores.

Amateur television. There are programs that enable the computer to be the heart of a slow-scan television (SSTV) system for worldwide transmission of still photos in black and white or in color. I've not encountered such programs for the VIC or 64, but several firms do provide programs for the Commodore machines that are designed to store and reproduce "video slides" for use as station IDs, video test patterns or artwork for both amateur SSTV and fast-scan (regular) television, thus making the VIC or 64 into a sort of TV keyboard.

Other applications. There are many other uses for the computer in the hamshack or listening post. Computing can be a stand-alone hobby, too; so if you purchase your VIC or 64 strictly for radio activities, its potential will lie largely untapped unless you challenge it with some of the more routine home and household applications. These might include maintaining personal finance and tax records; appointment and investment tracking; recipe collecting; household budgeting; and telecomputing.

Using the two hobbies, computers and ham radio, in tandem just makes good sense and is bound to make each one more interesting and enjoyable. And, with the cost of both the VIC and the 64 now down to very low levels, it's even practical to dedicate one computer to hamshack activities and a second to family computing purposes.

The Bottom Line

If your appetite is keen for more information on hamshack computing, you'll want to contact some of the software suppliers listed in the accompanying table. I've avoided making any judgements on the quality or suitability of an individual supplier's software; you'll have to be the judge on that score. My apologies to any VIC or 64 hamshack software supplier whose name is not in the list; it is a sampling only, and sources of new and exciting ham software appear almost daily.

If you're an enthusiastic ham or radio fan, you're likely to double your pleasure if you turn your VIC or 64 into a valuable hamshack helper with the right combination of software and imagination. R

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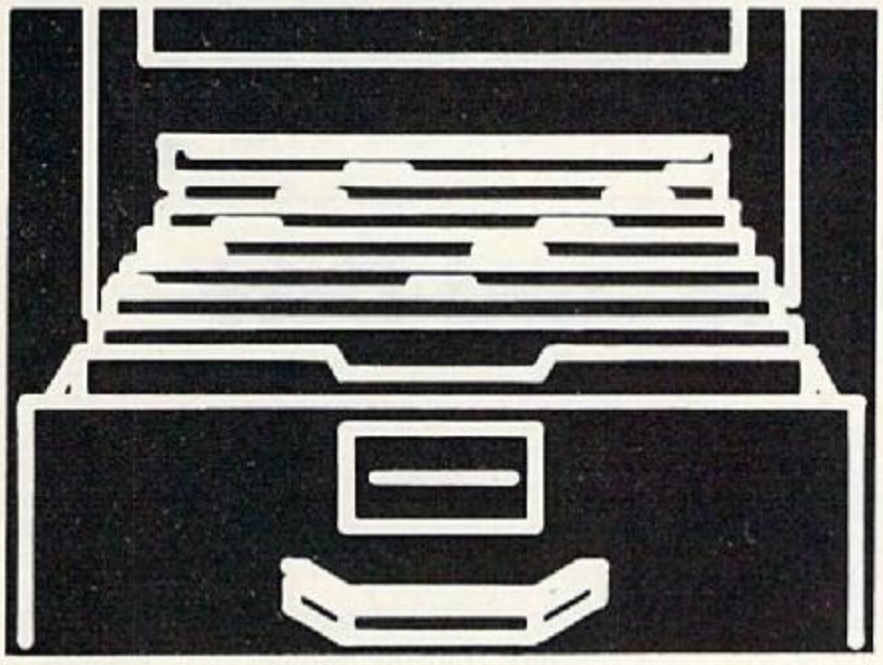

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Morse Code Medley

Polishes Your Dahs and Dits

If you're a ham radio operator or would like to be one, knowing Morse code is a must. Listen and learn with this program, which helps the beginner learn and enables the old hand to increase in speed and accuracy.

By Tom Meixner

All you hams out there already know that the first step in becoming a true "hammer" involves learning to send and receive Morse code quickly and accurately.

Morse Code Medley, a program for either the unexpanded VIC-20 or the Commodore 64, is built on the premise that if you actually hear the sound patterns of Morse code, rather than try to memorize dot-and-dash charts, you'll learn more quickly. From this premise, I developed three separate modes in the program—Practice, Quiz and Text.

About the Modes

The Practice mode is quite simple. After you run the program, just press P (for Practice), select a speed and then press any additional letter or number; the corresponding Morse code sequence will beep from your television speaker. At the same time, the letter or number you just pressed will be displayed in the upper left-hand corner of the screen. To exit the mode, change speed or quit, just press F5, F3 or F1, respectively.

The Quiz mode is something like the Practice mode in reverse. You're given brief instructions, and you select a speed. Immediately after that, the program randomly selects a letter or number and sends the Morse code pattern out to your TV's speaker. You must then identify the pattern by pressing a key. (If you are wrong, the correct character is displayed.) All the while, your score is being tallied; after ten patterns, it is displayed, and you may try again. Then, if you press Y, the menu will reappear. Pressing N stops the program.

The Text mode is a blend between the Practice and Quiz modes. After you select T (for Text) and a speed, a new screen with instructions appears. You can then type in text. For the VIC version, you may type in up to two lines (44 characters), while the Commodore 64 version enables you to type in three lines (120 characters).

The text is not seen on the screen at this time, but the number of characters typed is displayed in the home position. If you press the return key or reach the limit for text length, the string of text is relayed, in Morse code, for you to decipher. Just press F7 when you want to verify your translation. The text will then be printed on the screen.

Used together, all three modes provide an excellent means of mastering Morse code. The Practice mode aids in the association of alphanumerics with sound patterns; the Quiz mode aids in the association of sound patterns with alphanumerics (there *is* a difference); and the Text mode prepares the user for actual radio broadcasts. Since each mode offers a choice of seven different speeds, this program caters to both the advanced and beginning operator.

About the Program

The secret of this program's efficiency lies in the use of the same subroutines by each of the different modes. Lines 5–13, 60–83 and 90–200 (most of the program!) are used by every mode.

To see exactly how the program works, examine the flowchart (Fig. 1). The boxes formed by dotted lines are the core of the program as well as the subroutines used by all modes. All the solid lines and boxes trace the path the individual modes follow during the course of the program.

Morse Code Medley is a model of programming efficiency—but if your typing skills are less than efficient and you'd like this program without having to type it in, send me $3 along with a postpaid mailer and cassette, or just send $5, and *I'll* provide the cassette and mailer. R

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Address all author correspondence to Tom Meixner, RR 4, Box 273, Owatonna, MN 55060.

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Listing 1. Morse Code Medley program for the VIC-20.

```
5 POKE36879,104:PRINT"{SHFT CLR}{CTRL 2}{2 CRSR DNs}{4
  CRSR RTs}MORSE CODE"
6 PRINT"{CRSR DN}{2 CRSR RTs}{CRSR DN}{CTRL 9}P{CTRL 0}
  RACTICE, {CTRL 9}Q{CTRL 0}UIZ":POKE36878,15
7 PRINT"{CRSR DN}{5 CRSR RTs}OR {CTRL 9}T{CTRL 0}EXT?"
8 GETK$:IFK$=""THEN8
9 IFK$="P"THEN15
12 IFK$="Q"THEN52
13 IFK$="T"THENCLR:RESTORE:DIMS$(44):K$="T":GOTO285
14 K$="P"
15 PRINT"{SHFT CLR}{CRSR DN}{2 CRSR RTs}PRACTICE":PRINT
   "{2 CRSR DNs}{CRSR RT}{CTRL 9}F1{CTRL 0}: STOP":PRIN
   T"{CRSR DN}{CRSR RT}{CTRL 9}F3{CTRL 0}: CHANGE SPEED
   "
16 PRINT"{CRSR DN}{CRSR RT}{CTRL 9}F5{CTRL 0}: RETURN T
   O MENU":GOSUB60:GOTO84
```

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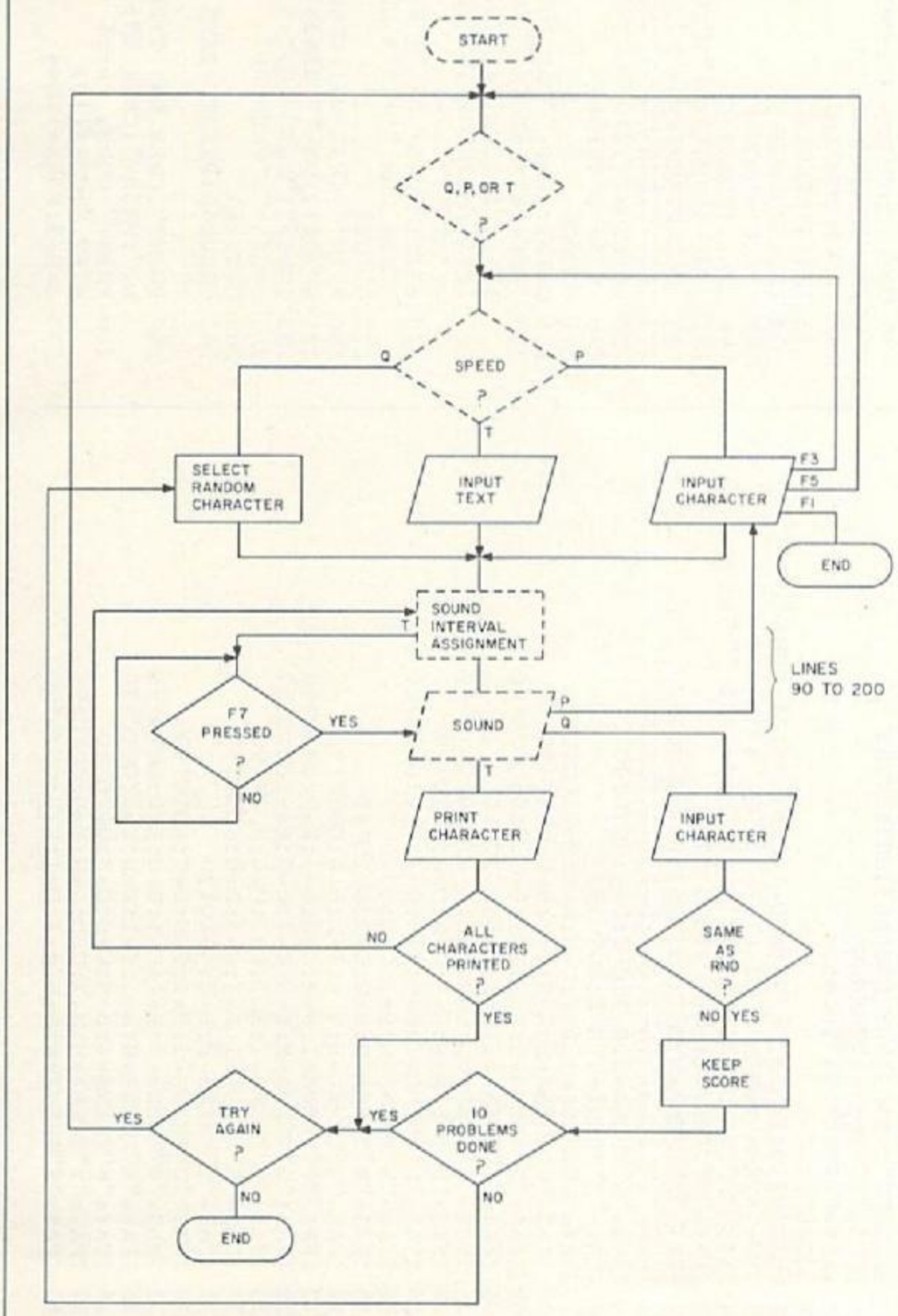

Fig. 1. Flowchart for Morse Code Medley program.

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Listing 1 continued.

```
 52 PRINT"{SHFT CLR}{2 CRSR DNs}{CRSR RT}{CRSR DN}ENTER
    A LETTER (OR"
 55 PRINT"{CRSR RT}{CRSR DN}NUMBER) AFTER EACH":PRINT"{C
    RSR DN}{CRSR RT}SERIES OF SOUNDS.":PRINT"{3 CRSR DNs
    }{2 CRSR RTs}PRESS ANY KEY"
 57 POKE198,0:WAIT198,1:K=210:Y=0:Z=0:POKE198,0:PRINT"{S
    HFT CLR}":GOSUB60:GOTO85
 60 PRINT"{HOME}"SPC(220)"SPEED?{CRSR DN}{2 CRSR LFs}A)2
    8LETTERS/MIN.":PRINT"{4 CRSR RTs}B)34{CRSR DN}{4 CRS
    R LFs}C)40{CRSR DN}{4 CRSR LFs}D)48"
 62 PRINT"{4 CRSR RTs}E)66{CRSR DN}{4 CRSR LFs}F)80{CRSR
     DN}{4 CRSR LFs}G)104"
 65 GETC$:IFC$="A"THENH=600:POKE7925,90:RETURN
 67 IFC$="B"THENH=500:POKE7947,90:RETURN
 70 IFC$="C"THENH=400:POKE7969,90:RETURN
 72 IFC$="D"THENH=300:POKE7991,90:RETURN
 75 IFC$="E"THENH=200:POKE8013,90:RETURN
 77 IFC$="F"THENH=150:POKE8035,90:RETURN
 80 IFC$="G"THENH=100:POKE8057,90:RETURN
 81 IFC$="{FUNCT 1}"THENEND
 82 IFC$="{FUNCT 5}"THEN5
 83 GOTO65
 84 POKE198,0:I=H/3:X=INT(RND(1)*43)+48:A$=CHR$(X)
 85 IFX=58ORX=59ORX=60ORX=61ORX=62ORX=64THEN84
 86 IFK$="P"THENGETA$:PRINT"{HOME}";A$:IFA$=""THEN86
 90 IFA$="A"THENA=I:B=H:C=0:GOTO190
 92 IFA$="B"THENA=H:B=I:C=I:D=I:E=0:GOTO190
 93 IFA$="C"THENA=H:B=I:C=H:D=I:E=0:GOTO190
 95 IFA$="D"THENA=H:B=I:C=I:D=0:GOTO190
 96 IFA$="E"THENA=I:B=0:GOTO190
 97 IFA$="F"THENA=I:B=I:C=H:D=I:E=0:GOTO190
100 IFA$="G"THENA=H:B=H:C=I:D=0:GOTO190
102 IFA$="H"THENA=I:B=I:C=I:D=I:E=0:GOTO190
105 IFA$="I"THENA=I:B=I:C=0:GOTO190
106 IFA$="J"THENA=I:B=H:C=H:D=H:E=0:GOTO190
107 IFA$="K"THENA=H:B=I:C=H:D=0:GOTO190
110 IFA$="L"THENA=I:B=H:C=I:D=I:E=0:GOTO190
112 IFA$="N"THENA=H:B=I:C=0:GOTO190
115 IFA$="M"THENA=H:B=H:C=0:GOTO190
116 IFA$="O"THENA=H:B=H:C=H:D=0:GOTO190
117 IFA$="P"THENA=I:B=H:C=H:D=I:E=0:GOTO190
120 IFA$="Q"THENA=H:B=H:C=I:D=H:E=0:GOTO190
123 IFA$="R"THENA=I:B=H:C=I:D=0:GOTO190
125 IFA$="S"THENA=I:B=I:C=I:D=0:GOTO190
127 IFA$="T"THENA=H:B=0:GOTO190
130 IFA$="U"THENA=I:B=I:C=H:D=0:GOTO190
132 IFA$="V"THENA=I:B=I:C=I:D=H:E=0:GOTO190
135 IFA$="X"THENA=H:B=I:C=I:D=H:E=0:GOTO190
136 IFA$="W"THENA=I:B=H:C=H:D=0:GOTO190
137 IFA$="Y"THENA=H:B=I:C=H:D=H:E=0:GOTO190
140 IFA$="Z"THENA=H:B=H:C=I:D=I:E=0:GOTO190
142 IFA$="0"THENA=H:B=H:C=H:D=H:E=H:F=0:GOTO190
145 IFA$="1"THENA=I:B=H:C=H:D=H:E=H:F=0:GOTO190
147 IFA$="2"THENA=I:B=I:C=H:D=H:E=H:F=0:GOTO190
150 IFA$="3"THENA=I:B=I:C=I:D=H:E=H:F=0:GOTO190
152 IFA$="4"THENA=I:B=I:C=I:D=I:E=H:F=0:GOTO190
155 IFA$="5"THENA=I:B=I:C=I:D=I:E=I:F=0:GOTO190
157 IFA$="6"THENA=H:B=I:C=I:D=I:E=100:F=0:GOTO190
160 IFA$="7"THENA=H:B=H:C=I:D=I:E=I:F=0:GOTO190
163 IFA$="8"THENA=H:B=H:C=H:D=I:E=I:F=0:GOTO190
165 IFA$="9"THENA=H:B=H:C=H:D=H:E=I:F=0:GOTO190
170 IFA$="."THENA=I:B=H:C=I:D=H:E=I:F=H:G=0:GOTO190
176 IFK$="T"THENIFA$=" "THENFORT=1TOI*2:NEXT
177 IFA$="{FUNCT 1}"THENIFK$="P"THENEND
178 IFA$="{FUNCT 3}"THENIFK$="P"THEN15
179 IFA$="{FUNCT 5}"THENIFK$="P"THENCLR:GOTO5
180 IFK$="Q"THEN84
182 IFK$="T"THENRETURN
185 GOTO86
190 FORS=1TO7:IFS=1THENGG=A
191 IFS=2THENGG=B
192 IFS=3THENGG=C
193 IFS=4THENGG=D
194 IFS=5THENGG=E
195 IFS=6THENGG=F
196 IFS=7THENGG=G
197 IFGG=0THENIFK$="T"THENRETURN
198 IFGG=0THENIFK$="P"THEN86
199 IFGG=0THENFORT=1TO325:NEXT:IFK$="Q"THEN255
200 POKE36876,210:FORT=1TOGG:NEXT:POKE36876,0:NEXT
210 IFK$="Q"THEN84
211 GOTO86
255 GETB$:IFB$=""THEN255
260 IFB$=A$THENPRINT"{HOME}{CRSR DN}{CRSR RT}RIGHT!!("A
    $"){4 SPACEs}":Y=Y+1:Z=Z+1
265 IFB$><A$THENPRINT"{HOME}{CRSR DN}{CRSR RT}WRONG!!!!
     ("A$")":Z=Z+1
270 PRINT"{CRSR DN}"Y"RIGHT OUT OF"Z:IFZ=10THENPRINT"{2
     CRSR DNs}"Y*10"% CORRECT":GOTO280
275 GOTO84
280 PRINT"{CRSR DN}{CRSR RT}TRY AGAIN??"
281 GETD$:IFD$=""THEN281
282 IFD$="Y"THENY=0:Z=0:GOTO5
283 IFD$<>"Y"THENEND
284 GOTO281
285 GOSUB60:PRINT"{SHFT CLR}{CRSR DN}{UP ARROW}{CRSR DN
    }"
287 PRINT"{CRSR DN} TYPE TEXT THEN PRESS{2 SPACEs}RETUR
    N.":PRINT"{CRSR DN} AFTER DECIPHERING"
288 PRINT" CODE, PRESS {CTRL 9}F7{CTRL 0} TO":PRINT" VE
    RIFY.";CHR$(13)
290 I=H/3:FORY=1TO44
```

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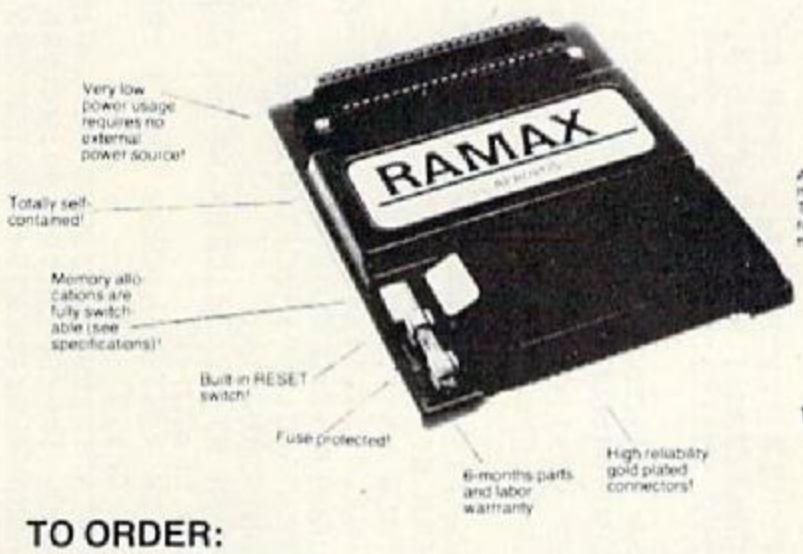
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Listing 1 continued.

```
302 GETS$(Y):IFS$(Y)=""THEN302
304 U=Y:PRINT"{HOME}"U:IFASC(S$(Y))=13THENY=44
306 NEXTY
307 FORY=1TOU:A$=S$(Y):FORT=1TOI:NEXT:GOSUB90:NEXT
308 GETF$:IFF$=""THEN308
309 IFF$="{FUNCT 7}"THEN312
310 GOTO308
312 PRINTSPC(220):FORY=1TOU:A$=S$(Y):PRINTA$;:FORT=1TOI
    :NEXT:GOSUB90:NEXT
320 POKE198,0:GOTO280
```

Listing 2. Morse Code Medley program for the C-64.

```
5 POKE53280,0:POKE53281,6:PRINT"{SHFT CLR}{CTRL 2}{2 CR
  SR DNs}{8 CRSR RTs}MORSE CODE MEDLY"
6 PRINT"{CRSR DN}{9 CRSR RTs}{CRSR DN}{CTRL 9}P{CTRL 0}
  RACTICE, {CTRL 9}Q{CTRL 0}UIZ":POKE54296,15:SS=54272
7 PRINT"{CRSR DN}{12 CRSR RTs}OR {CTRL 9}T{CTRL 0}EXT?"
8 GETK$:IFK$=""THEN8
9 IFK$="P"THEN15
12 IFK$="Q"THEN52
13 IFK$="T"THENCLR:RESTORE:DIMS$(120):K$="T":GOTO285
14 K$="P"
15 PRINT"{SHFT CLR}{CRSR DN}{2 CRSR RTs}PRACTICE MODE":
   PRINT"{2 CRSR DNs}{CRSR RT}{CTRL 9}F1{CTRL 0}: STOP"
   :PRINT"{CRSR DN}{CRSR RT}{CTRL 9}F3{CTRL 0}: CHANGE
   SPEED"
16 PRINT"{CRSR DN}{CRSR RT}{CTRL 9}F5{CTRL 0}: RETURN T
   O MENU":GOSUB60:GOTO84
52 PRINT"{SHFT CLR}{CRSR DN}{2 CRSR RTs}QUIZ MODE"
54 PRINT"{2 CRSR DNs}{CRSR RT}{CRSR DN}ENTER A LETTER (
   OR"
55 PRINT"{CRSR RT}{CRSR DN}NUMBER) AFTER EACH":PRINT"{C
   RSR DN}{CRSR RT}SERIES OF SOUNDS."
56 PRINT"{3 CRSR DNs}{2 CRSR RTs}PRESS ANY KEY"
57 POKE198,0:WAIT198,1:K=210:Y=0:Z=0:POKE198,0:PRINT"{S
   HFT CLR}":GOSUB60:GOTO85
60 PRINT"{HOME)"SPC(255)SPC(145)"SPEED?{CRSR DN}{2 CRSR
    LFs}A)28LETTERS/MIN."
61 PRINT"{4 CRSR RTs}B)34{CRSR DN}{4 CRSR LFs}C)40{CRSR
    DN}{4 CRSR LFs}D)48"
62 PRINT"{4 CRSR RTs}E)66{CRSR DN}{4 CRSR LFs}F)80{CRSR
    DN}{4 CRSR LFs}G)104"
65 GETC$:IFC$="A"THENH=600:POKE1467,90:RETURN
67 IFC$="B"THENH=500:POKE1507,90:RETURN
70 IFC$="C"THENH=400:POKE1547,90:RETURN
72 IFC$="D"THENH=300:POKE1587,90:RETURN
75 IFC$="E"THENH=200:POKE1627,90:RETURN
77 IFC$="F"THENH=150:POKE1667,90:RETURN
80 IFC$="G"THENH=100:POKE1707,90:RETURN
81 IFC$="{FUNCT 1}"THENEND
82 IFC$="{FUNCT 5}"THEN5
83 GOTO65
84 POKE198,0:I=H/3:X=INT(RND(1)*43)+48:A$=CHR$(X)
85 IFX=58ORX=59ORX=60ORX=61ORX=62ORX=64THEN84
86 IFK$="P"THENGETA$:PRINT"{HOME}";A$:IFA$=""THEN86
90 IFA$="A"THENA=I:B=H:C=0:GOTO190
92 IFA$="B"THENA=H:B=I:C=I:D=I:E=0:GOTO190
93 IFA$="C"THENA=H:B=I:C=H:D=I:E=0:GOTO190
95 IFA$="D"THENA=H:B=I:C=I:D=0:GOTO190
96 IFA$="E"THENA=I:B=0:GOTO190
97 IFA$="F"THENA=I:B=I:C=H:D=I:E=0:GOTO190
100 IFA$="G"THENA=H:B=H:C=I:D=0:GOTO190
102 IFA$="H"THENA=I:B=I:C=I:D=I:E=0:GOTO190
105 IFA$="I"THENA=I:B=I:C=0:GOTO190
106 IFA$="J"THENA=I:B=H:C=H:D=H:E=0:GOTO190
107 IFA$="K"THENA=H:B=I:C=H:D=0:GOTO190
110 IFA$="L"THENA=I:B=H:C=I:D=I:E=0:GOTO190
112 IFA$="N"THENA=H:B=I:C=0:GOTO190
115 IFA$="M"THENA=H:B=H:C=0:GOTO190
116 IFA$="O"THENA=H:B=H:C=H:D=0:GOTO190
117 IFA$="P"THENA=I:B=H:C=H:D=I:E=0:GOTO190
120 IFA$="Q"THENA=H:B=H:C=I:D=H:E=0:GOTO190
123 IFA$="R"THENA=I:B=H:C=I:D=0:GOTO190
125 IFA$="S"THENA=I:B=I:C=I:D=0:GOTO190
127 IFA$="T"THENA=H:B=0:GOTO190
130 IFA$="U"THENA=I:B=I:C=H:D=0:GOTO190
132 IFA$="V"THENA=I:B=I:C=I:D=H:E=0:GOTO190
135 IFA$="X"THENA=H:B=I:C=I:D=H:E=0:GOTO190
136 IFA$="W"THENA=I:B=H:C=H:D=0:GOTO190
137 IFA$="Y"THENA=H:B=I:C=H:D=H:E=0:GOTO190
140 IFA$="Z"THENA=H:B=H:C=I:D=I:E=0:GOTO190
142 IFA$="0"THENA=H:B=H:C=H:D=H:E=H:F=0:GOTO190
145 IFA$="1"THENA=I:B=H:C=H:D=H:E=H:F=0:GOTO190
147 IFA$="2"THENA=I:B=I:C=H:D=H:E=H:F=0:GOTO190
150 IFA$="3"THENA=I:B=I:C=I:D=H:E=H:F=0:GOTO190
152 IFA$="4"THENA=I:B=I:C=I:D=I:E=H:F=0:GOTO190
155 IFA$="5"THENA=I:B=I:C=I:D=I:E=I:F=0:GOTO190
157 IFA$="6"THENA=H:B=I:C=I:D=I:E=100:F=0:GOTO190
160 IFA$="7"THENA=H:B=H:C=I:D=I:E=I:F=0:GOTO190
163 IFA$="8"THENA=H:B=H:C=H:D=I:E=I:F=0:GOTO190
165 IFA$="9"THENA=H:B=H:C=H:D=H:E=I:F=0:GOTO190
170 IFA$="."THENA=I:B=H:C=I:D=H:E=I:F=H:G=0:GOTO190
176 IFK$="T"THENIFA$=" "THENFORT=1TOI*2:NEXT
177 IFA$="{FUNCT 1}"THENIFK$="P"THENEND
178 IFA$="{FUNCT 3}"THENIFK$="P"THEN15
179 IFA$="{FUNCT 5}"THENIFK$="P"THENCLR:GOTO5
180 IFK$="Q"THEN84
182 IFK$="T"THENRETURN
185 GOTO86
```

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Listing 2 continued.

```
190 FORS=1TO7:IFS=1THENGG=A
191 IFS=2THENGG=B
192 IFS=3THENGG=C
193 IFS=4THENGG=D
194 IFS=5THENGG=E
195 IFS=6THENGG=F
196 IFS=7THENGG=G
197 IFGG=0THENIFK$=""T""THENRETURN
198 IFGG=0THENIFK$="P"THEN86
199 IFGG=0THENFORT=1TO325:NEXT:IFK$="Q"THEN255
200 POKE54278,100:POKE54273,34:POKE54272,75:POKE54276,3
    3
201 FORT=1TOGG:NEXT
202 POKE54278,0:POKE54276,0
203 NEXT
210 IFK$="Q"THEN84
211 GOTO86
255 GETB$:IFB$=""THEN255
260 IFB$=A$THENPRINT"{HOME}{CRSR DN}{CRSR RT}RIGHT!!("A
    $"){4 SPACES}":Y=Y+1:Z=Z+1
265 IFB$><A$THENPRINT"{HOME}{CRSR DN}{CRSR RT}WRONG!!!!
    ("A$")":Z=Z+1
270 PRINT"{CRSR DN}"Y"RIGHT OUT OF"Z:IFZ=10THENPRINT"{2
    CRSR DNs}"Y*10"% CORRECT":GOTO280
275 GOTO84
280 PRINT"{CRSR DN}{CRSR RT}TRY AGAIN??"
281 GETD$:IFD$=""THEN281
282 IFD$="Y"THENY=0:Z=0:GOTO5
283 IFD$<>"Y"THENEND
284 GOTO281
285 GOSUB60:PRINT"{SHFT CLR}{11 CRSR RTs}TEXT MODE":PRI
    NT"{HOME}{CRSR DN}{UP ARROW}{CRSR DN}"
287 PRINT"{CRSR DN} TYPE TEXT THEN PRESS{2 SPACEs}RETUR
    N.":PRINT" (120 CHARACTER LIMIT)"
288 PRINT"{CRSR DN} AFTER DECIPHERING"
289 PRINT" CODE, PRESS {CTRL 9}F7{CTRL 0} TO":PRINT" VE
    RIFY.";CHR$(13)
290 I=H/3:FORY=1TO120
302 GETS$(Y):IFS$(Y)=""THEN302
304 U=Y:PRINT"{HOME}"U:IFASC(S$(Y))=13THENY=120:GOTO308
305 NEXT
306 GETH$:IFH$=""THEN306
307 IFH$<>CHR$(13)THEN306
308 FORY=1TOU:A$=S$(Y):FORT=1TOI:NEXT:GOSUB90:NEXT
309 GETF$:IFF$=""THEN309
310 IFF$="{FUNCT 7}"THEN312
311 GOTO309
312 PRINTSPC(255)SPC(145):FORY=1TOU:A$=S$(Y):PRINTA$;:F
    ORT=1TOI:NEXT:GOSUB90
320 NEXT:POKE198,0:GOTO280
```

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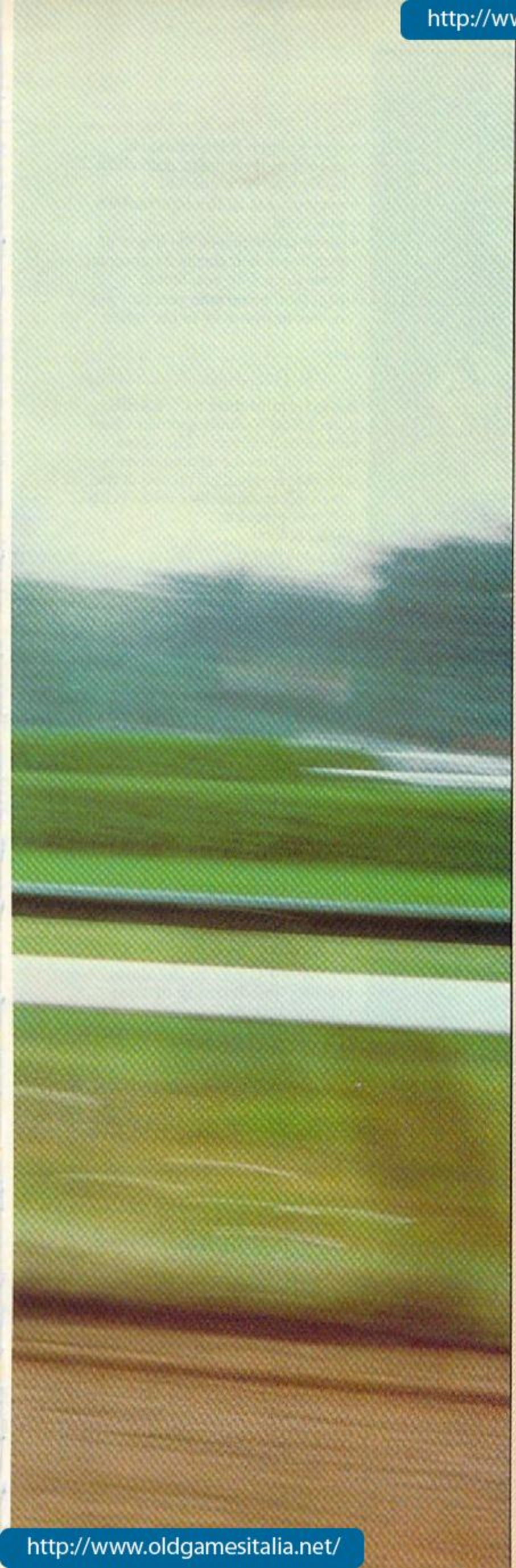

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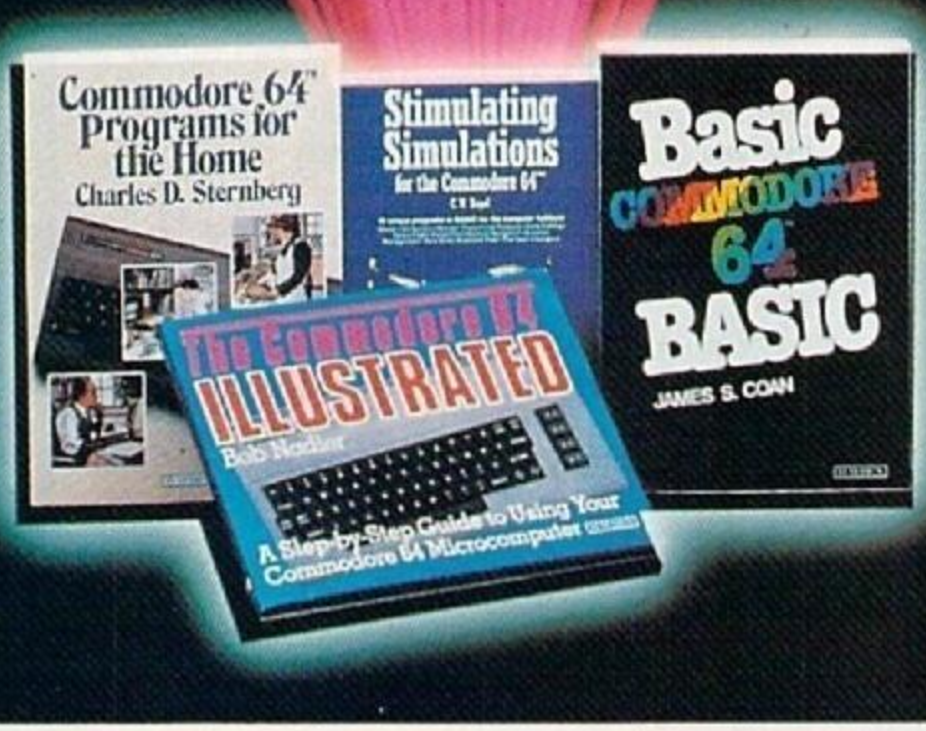
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Table 1. Description of main program.

Line Number	
15—	Sets R1 (amount of money held) to 500.
20—	Clears screen. Calls on subroutine 1200 to put row of hyphens across screen. Describes variables ML, LA.
22—	Sets ML (Memory Location) to 7680, the starting address of the upper left of the screen. Sets LA (lines across) to 22. Poke 36879: Sets color and background.
40—	Calls on subroutine 1200 to put a row of hyphens across screen.
80—	Prints the title and calls on subroutine 1200 to put a row of hyphens across screen.
85—	Delays a bit, then starts.
86—	Sets starting position of horses.
90–110—	Give instructions.
140—	Calls on subroutine 1200 to put a row of hyphens across screen.
270—	Gets the number of the horse being bet on.
300—	Calls on subroutine 1200 to put a row of hyphens across screen.
310—	Asks for bet.
320—	If bet is less than or equal to amount held, goes to 400.
330—	(Otherwise) Tells how much is left to bet.
350—	Asks for bet again. (310).
400—	Clears screen and calls on subroutine 2000 to display horses.
410—	Calls on subroutine 4000 to display starting gate.
600—	Gets a random number between 1 and 5.
620—	Calls on subroutine 1000 to add 1 to a counter corresponding to the horse whose number has come up. Calls on subroutine 2000 to put horses on screen. (If a horse's counter has been incremented, its position is advanced.)
630—	Adds 1 to a counter corresponding to the horse whose number has come up.
640—	If the horse that just moved is not near the right side of the screen, goes to 600 to make another horse move.
650—	If a horse has won, falls into here. Delays a bit.
660—	Tells who is the winner.
665—	Prints a row of hyphens across the screen.
670—	If the horse picked is the winning horse, adds the winnings to the amount held, goes to 750.
680—	If the horse picked is not the winner, falls into here. Displays "You lose." Subtracts bet from amount held.
685—	Tells how much money is left.
687—	If no money is left, displays "You're broke." Ends program.
690—	Asks if another game is to be played.
691—	Gets reply.
700—	If reply is "Y," goes to 20 to start again.
710—	If reply is not "Y," falls through to here. Restores screen color and background. Ends the program.
750—	Displays "You win" and how much won.
760—	Displays amount held.
770—	Goes to 690 to ask about another game.
990—	Ends.

Table 2. Descriptions of subroutines.

Subroutines	
1000—	Adds 1 to X1, X2, X3, X4 or X5, depending on the random number that came up.
1200—	Puts a row of asterisks across the screen.
2000—	Advances the horse whose number has come up. Leaves the other horses where they were.
3000—	Makes the sound of a starting gun and galloping of horses.

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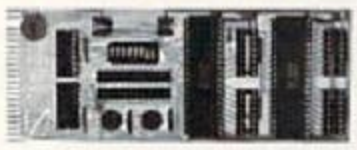

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Table 3. Definitions of variables.

Variables

ML— Memory location of horse.
LA— Lines across screen, 22 for VIC.
X1— Position of horse 1.
X2— Position of horse 2.
X3— Position of horse 3.
X4— Position of horse 4.
X5— Position of horse 5.
R1— Amount of money held.
I— Index variable.
R— Random number.
H— The horse bet on.
B— Amount of bet.
B( )—Array used to keep track of position of each horse. B(1) is for horse #1, B(2) is for horse #2, etc.
Z$— Reply Y/N.
J— Index variable.
Y— "Y" coordinate on screen. (How many lines down from top.)
J3— Index variable.
Y— Index variable.
J2— Index variable.
L— Index variable.
M— Index variable.

Listing of Playing the Ponies program.

```
10 REM HORSE RACE
15 R1=500 :REM R1 = AMT OF $ LEFT
20 PRINT"{SHFT CLR}": GOSUB1200:REM ML=MEMORY LOCATION
     FOR HORSE, LA= LINES ACROSS
22 ML=7680:LA=22:POKE 36879,8
30 B=0:R=0 :FOR I=1TO5:A(I)=0:B(I)=0:NEXT I
40 GOSUB1200
80 PRINT"WELCOME{3 SPACEs}TO{3 SPACEs}THE{7 SPACEs}VIC
     RACE TRACK": GOSUB1200
85 FOR I = 1 TO 500:NEXT I:REM GAME STARTS HERE
86 X1=1:X2=1:X3=1:X4=1:X5=1:REM RESET START POSIT
90 PRINT"YOU HAVE ";R1 " TO BET"
100 PRINT"PAYOFF IS 4:1 TO WIN":PRINT
110 PRINT"PICK A HORSE, FROM 1-5";
140 GOSUB1200
270 INPUT" ";H
280 IF H > 0 AND H < 6 THEN 310
290 PRINT"HORSES ARE NUMBERED{3 SPACEs}1-5. ENTER AGAIN "
300 GOSUB1200:GOTO 270
310 PRINT"WHAT IS YOUR BET ";:INPUT B:B=ABS(B)
320 IF B< R1 OR B = R1 THEN 400
330 PRINT"YOU HAVE $";R1;". ";
350 GOTO 310
400 PRINT"{SHFT CLR}";:GOSUB2000:REM TO PUT HORSES ON
410 GOSUB4000:REM START GATE
600 R =INT(5*RND(1)+1)
620 GOSUB1000:GOSUB2000
630 B(R)=B(R)+1
640 IF B(R) < (LA-2)THEN 600
650 PRINT" ":FOR I=1TO 1000 :NEXT I
660 PRINT"{SHFT CLR}THE WINNER IS NUMBER";R
665 FORI2=1TOLA:PRINT"-";:NEXT I2
670 IF H = R THEN R1 = R1 +(4 * B):GOTO 750
680 PRINT"YOU LOSE.":R1=R1-B
685 PRINT"YOU HAVE $";R1;"LEFT."
687 IF R1<= 0 THEN PRINT"YOU'RE BROKE. COME BACK ANOTHE
     R DAY":END
690 Z$="":PRINT "ANOTHER RACE (Y OR N)"
691 INPUTZ$
700 IF Z$="Y"THENGOTO 20
710 :POKE 36879,25:END
```

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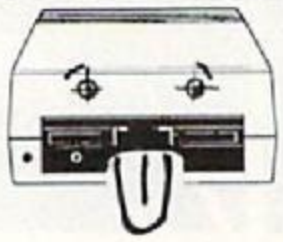

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Listing continued.

```
750 PRINT"YOU WIN $";4*B
760 PRINT"YOU NOW HAVE $";R1
770 GOTO 690
990 END
1000 REM ADD TO APPROPRIATE COUNTER
1090 IFR=1THENX1=X1+1
1092 IFR=2THENX2=X2+1
1093 IFR=3THENX3=X3+1
1094 IFR=4THENX4=X4+1
1095 IFR=5THENX5=X5+1
1100 RETURN
1200 PRINT:FOR J = 1 TO LA:PRINT"-";:NEXT J:PRINT:RETUR
     N
2000 REM TO PUT HORSES ON SCREEN
2010 Y=1:PRINT"{SHFT CLR}"
2020 POKE ML+X1+22*Y,94
2021 POKE ML+X1-1+22*Y,48+1
2022 POKE ML+X1-2+22*Y,32
2030 Y=5
2040 POKE ML+X2+22*Y,94
2041 POKE ML+X2-1+22*Y,48+2
2042 POKE ML+X2-2+22*Y,32
2050 Y=9
2060 POKE ML+X3+22*Y,94
2061 POKE ML+X3-1+22*Y,48+3
2062 POKE ML+X3-2+22*Y,32
2070 Y=13
2080 POKE ML+X4+22*Y,94
2081 POKE ML+X4-1+22*Y,48+4
2082 POKE ML+X4-2+22*Y,32
2090 Y=17
2100 POKE ML+X5+22*Y,94
2101 POKE ML+X5-1+22*Y,48+5
2102 POKE ML+X5-2+22*Y,32
2130 REM RETURN
3000 REM TO MAKE SOUND
3010 POKE36878,15:POKE36874,200
3020 FORJ3=1TO5:NEXT J3:POKE 36874,0
3030 POKE36878,0:RETURN
4000 REM SUB TO MAKE STARTING GATE AND GUN
4010 FORY =0TO22:POKEML+3+22*Y,115:NEXT Y
4020 FORJ2=1TO1011:NEXT J2
4040 POKE 36877,220:FORL=10TO0STEP-1
4050 POKE 36878,L:FORM=1TO70 :NEXT M:NEXT L:POKE 36877,
     0:POKE 36878,0
4100 RETURN
```


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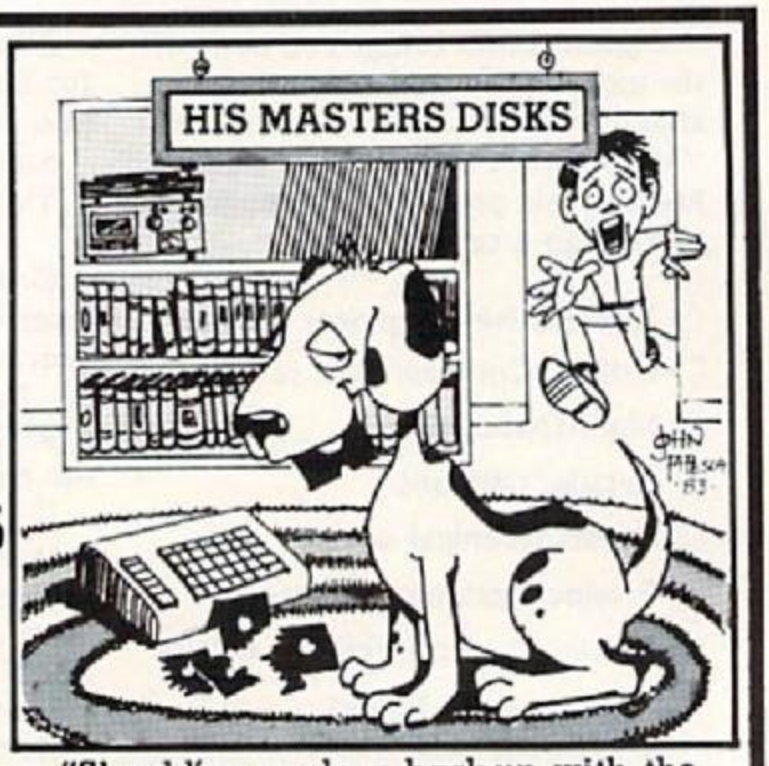

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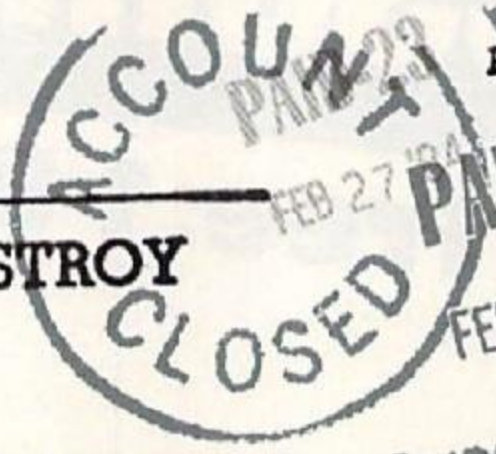

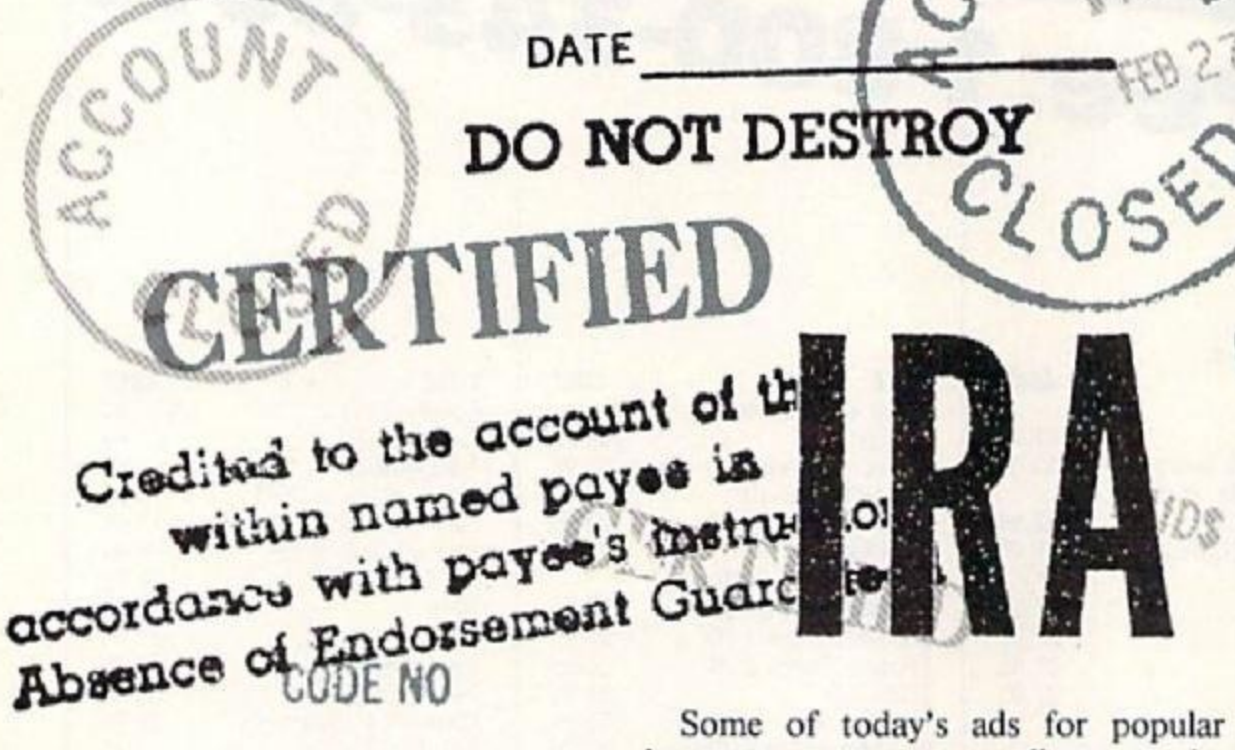

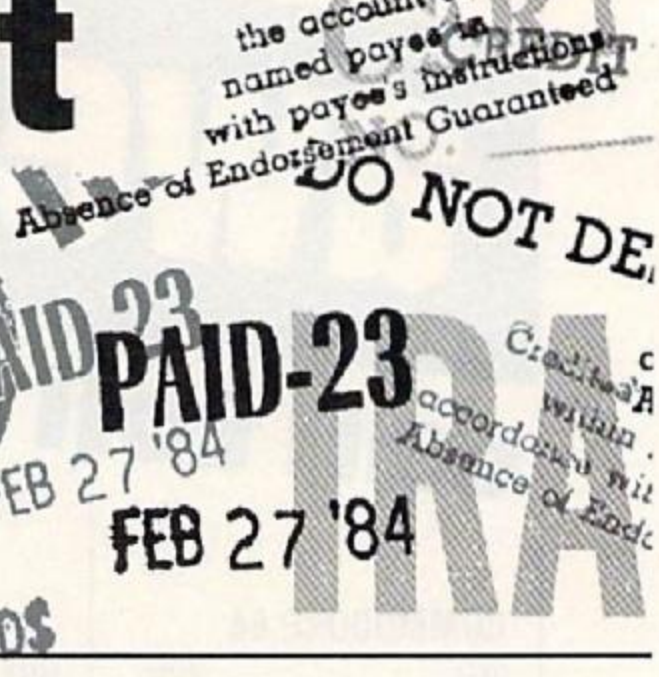

You can bank on this program that will balance your checking account, keep track of your transactions and help you to better budget your finances.

By John Schmoyer

RUN It Right

Commodore 64
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Address all author correspondence to John Schmoyer, 6435 Greenback Lane, #2, Citrus Heights, CA 95621.

Some of today's ads for popular home computers try to sell you on the idea that you *need* to own one (or more!) of these marvelous electronic machines.

You're told that you mustn't get caught behind the times. You need hands-on experience with the wave of the future. You owe it to yourself and to the security of your family to buy an XYZ brand home computer. If nothing else, you should think of the children! They've got to be familiar with computers just to survive in the computer age.

But what about the thousands of people who "think of the children," only to find their children do little more than play games on the thing? For example, my nine-year-old son has very little interest in programming the C-64, but he loves to play Q*bert and Congo Bongo on it. Where does that leave me and thousands of others like me, who've sunk a sum of money into a home computer?

Much of the software available for personal computers is game software. I like to play games, too, but I also have a practical side, especially when it comes to something in which I've invested my hard-earned money. Fortunately, the quantity of software available for more practical uses is growing.

In this article, I'd like to share with you what I consider to be a practical program, and I think you'll find it extremely helpful and easy to use.

What the Program Does

The Check Manager program will keep track of all your checking account activity, and will go beyond simply recording the information. It allows you to print a complete list of your transactions on the screen or on a printer, if you have one. Having all of your business on one or two pages reduces the time it takes you to reconcile the bank statement. But it doesn't stop there.

What about your family budget? Maybe you've been having difficulty identifying where all your money is going. Maybe it's time to start keeping better track of how much is spent on food, clothing, transportation and other items. The Check Manager can help here, too.

Operating the Program

Initially, The Check Manager prompts you for a filename. This feature allows you to keep a full month's activity in a single file. You can retain the file as long as you like. Simply assign a new filename for each new month. (I always name the file by the month I am entering.) For example, if you're well into the month of April and want to see what you did in March, enter March as the filename, and presto, you have all of March's activity at your fingertips!

If you enter a filename that's not currently on the disk, the program responds, "Hmmm, is this a new one?" You must respond with a Y or an N. This is a little safety feature designed to catch errors you might make while typing in the filename. If the file is on disk, the information is loaded into memory.

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Next, the master menu appears. It looks like this:

Check Manager Menu

1 = Add Transactions
2 = Change Transactions
3 = Print Check Register
4 = Balance Inquiry
5 = Budget Analysis
6 = Quit

You have six options. The first two allow you to add new transactions or make changes to existing ones. The third option lets you print a register of all the activity on file. You may print the register on the printer or the screen.

Option four computes and displays your current account balance. This is the quick and easy way to discover how much you've got in the account.

Option five lets you analyze how much money your family has been spending on the various budget categories you've set up. It will also compute the percentage this amount represents compared to your entire monthly spending. The sixth option lets you exit the program.

How the Program Works

Let's examine Check Manager line by line to see how it works.

Line 100—Sets 150 as the maximum number of transactions that the program will allow you to enter. I rarely have more than 75 transactions in any one month, so 150 is probably adequate. You can increase this, but watch out—you may run out of memory.

Lines 110–175—Define various control codes, screen and character colors. You may change the color selections to whatever you wish.

Lines 180–185—Define a variable of 40 spaces, and another of 80 equals signs; they're used throughout the program.

Line 190—Initializes the screen and border colors.

Lines 200–210—Define the array variables that will contain the transactions.

DT$ is the transaction date. Use the standard MM/DD/YY format when entering this date; BC$ is the budget category, which can be whatever you want it to be, as long as it's no more than three characters long; DS$ is the activity description, up to twenty characters in length; CK$ is the check number, up to four characters in length; CA$ is the check amount (or amount of bank charges, withdrawals and so on); DA$ is the deposit amount.

Transfers from your checking account into savings should be entered as a negative deposit amount, so your total spending picture will not be distorted. Your total spending is computed by adding up all of the check amounts.

Lines 220–300—Initialize the character color and display a program identification message.

Lines 400–880—Request the filename. If nothing is entered, or if you type in END, the program quits. The program tries to open the file on disk. If the file is not found, a message is displayed in line 520, and you're asked to confirm that you want to create a new file by that name. However, the file is not actually created until later, after you've entered transactions.

If the file is found, the transactions are read into the array variables defined in lines 200 and 210. The variable "Lines" keeps track of the number of transactions in memory.

Lines 1000–1220—Display the main program menu and accept your option. The program then performs the function requested. Option six will end the program.

Lines 2000–2440—This is the transaction add routine.

Line 2000—Makes sure you don't try to add more transactions than the maximum number allowed (defined in line 100).

Line 2010—Clears the screen and displays the new transaction number.

Lines 2020–2130—Display prompts.

Line 2130—Check the variable DR, which is set to 1 only in the change routine. It signifies "display the prompts screen, and return to the change routine."

Line 2180—Performs a very useful function. If there's at least one transaction on file, the new transaction date will default to the date of the last transaction entered. This saves time and keystrokes, since many checks are often written on the same day.

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Listing of Check Manager program.

```
1 GOTO 1ØØ
2 !=================================================
  =====!
3 !{57 SPACEs}!
4 ! PROGRAM: CHECK MANAGER{1Ø SPACEs}DATE: FEB 1, 1984{
  7 SPACEs}!
5 ! AUTHOR : JOHN SCHMOYER, CONSULTANT{22 SPACEs}!
6 !{57 SPACEs}!
7 !=================================================
  =====!
8 !
9 !
1ØØ MAXSIZE = 15Ø{3 SPACEs}: REM MAX # TRANSACTIONS
11Ø CSCREEN = 5328Ø : REM SCREEN COLOR POKE LOCATION
12Ø CHARS${2 SPACEs}= "{CTRL 2}"{3 SPACEs}: REM CHARACT
    ER COLOR = WHITE
13Ø SCREEN{2 SPACEs}= Ø{5 SPACEs}: REM SCREEN COLOR = B
    LACK
14Ø HOME${3 SPACEs}= "{HOME}"{3 SPACEs}: REM CURSOR HOM
    E
15Ø CLSCREEN$ = "{SHFT CLR}" : REM CLEAR SCREEN
16Ø LOWERCASE$ = CHR$(14)
17Ø UPPERCASE$ = CHR$(142)
175 CR$ = CHR$(13)
18Ø SPACES$ = "{4Ø SPACEs}" : REM 4Ø SPACES
185 FOR N=1 TO 8 : EQUAL$=EQUAL$+"==========" : NEXT N
19Ø POKE CSCREEN,SCREEN : POKE CSCREEN + 1,SCREEN
2ØØ DIM DT$(MAXSIZE),BC$(MAXSIZE),DS$(MAXSIZE),CK$(MAXS
    IZE)
21Ø DIM CA$(MAXSIZE),DA$(MAXSIZE)
22Ø PRINT CLSCREEN$;LOWERCASE$ : PRINT CHARS$
23Ø PRINT HOME$;"{CTRL 9}";SPACES$;
24Ø PRINT"{CTRL 9} {CTRL Ø}{11 SPACEs}{SHFT C}HECK {SHF
    T B}OOK {SHFT M}ANAGER{9 SPACEs}{CTRL 9} {CTRL Ø}";
25Ø PRINT"{CTRL 9}";SPACES$;
26Ø FOR I = 4 TO 23
27Ø PRINT "{CTRL 9} {CTRL Ø}";LEFT$(SPACES$,38);"{CTRL
    9} {CTRL Ø}";
28Ø NEXT I
29Ø PRINT "{CTRL 9}{9 SPACEs}{SHFT P}RESS {SHFT A}NY {S
    HFT K}EY {SHFT T}O {SHFT B}EGIN{9 SPACEs}";
3ØØ GET A$ : IF A$="" THEN 3ØØ
4ØØ PRINT CLSCREEN$;
41Ø PRINT "{CTRL 9}{SHFT P}LEASE ENTER THE CHECKS FILE
    NAME"
42Ø PRINT "{CTRL Ø}--------------------------------"
43Ø CFILE$="" : INPUT CFILE$
44Ø IF CFILE$ = "" OR CFILE$ = "END" THEN 99ØØ
46Ø OPEN 15,8,15,"IØ" : OPEN 5,8,5,CFILE$+",S,R"
48Ø INPUT#15,EN,EM$,ET,ES
5ØØ IF EN < 2Ø THEN 7ØØ
52Ø PRINT : PRINT "{2 SPACEs}{SHFT H}MMMM, IS THIS A NE
    W ONE"; : INPUT NW$
54Ø IF NW$ = "Y" OR NW$ = "YES" THEN 6ØØ
56Ø CLOSE 15 : CLOSE 5
58Ø GOTO 4ØØ
6ØØ LINES = Ø
62Ø GOTO 1ØØØ
7ØØ PRINT : PRINT "{2 SPACEs}{SHFT R}EADING THE FILE ..
    . PLEASE WAIT"
71Ø LINES = Ø
72Ø INPUT#5,QA$,QB$,QC$,QD$,QE$,QF$
74Ø RS = ST
76Ø LINES = LINES + 1
78Ø DT$(LINES) = QA$ : BC$(LINES) = QB$
8ØØ DS$(LINES) = QC$ : CK$(LINES) = QD$
82Ø CA$(LINES) = QE$ : DA$(LINES) = QF$
86Ø IF RS = Ø THEN 72Ø
88Ø CLOSE 5
1ØØØ PRINT CLSCREEN$
```

More →

Lines 2190-2200—Accept the date. If you enter END, the transactions are saved on disk, and control is returned to the main menu.

Lines 2220-2360—Accept the remaining items. These items are entered via a special entry routine, starting at line 5000. That routine displays an underline prompt, showing you the maximum allowable size of each data item. If you enter nothing for an item, a single underscore character is displayed there to signify no entry. The item will actually be blank, so don't let this throw you.

Also, when entering the transaction description, do not enter commas. Basic thinks that commas separate individual data items, and will respond with EXTRA IGNORED if you do enter a comma.

Line 2400—Increments the transaction count by one.

Lines 2410-2430—Ask whether or not the entries are OK. If you answer N, then control goes to the edit routine, starting at line 2540.

If you must change an item at this point, do it carefully! For example, if you need to blank out an item, you must use shifted spaces—ordinary spaces won't work. This seems to be a problem with the Basic interpreter. When in doubt, use shifted spaces, and all will be well.

Line 2440—Clears the edit flag and goes to line 2000, so you can enter another transaction.

Lines 2500-2740—This is the transaction edit routine.

Line 2500—Prompts you for the transaction number. If you enter zero, the transactions are saved on disk and control returns to the main menu.

Line 2520—Makes sure you enter a valid transaction number. Line 2530 sets the variable DP and performs the screen display routine at line 2020 of the add routine.

Lines 2540-2670—Display the data items and allow you to change them.

Lines 2700-2720—Ask you if the data is correct. If you say N, you'll have the opportunity to skip through each item again, changing whatever you need to change. Remember to use shifted spaces if you need to blank out an item.

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Listing continued.

```
1Ø2Ø PRINT"{CTRL 9}{2 CRSR DNs}{1Ø SPACEs}{SHFT C}HECK
     {SHFT M}ANAGER {SHFT M}ENU{11 SPACEs}{CTRL Ø}"
1Ø4Ø PRINT : PRINT : PRINT TAB(8);"1 = {SHFT A}DD {SHFT
      T}RANSACTIONS"
1Ø6Ø PRINT : PRINT TAB(8);"2 = {SHFT C}HANGE {SHFT T}RA
     NSACTIONS"
11ØØ PRINT : PRINT TAB(8);"3 = {SHFT P}RINT {SHFT C}HEC
     K {SHFT R}EGISTER"
112Ø PRINT : PRINT TAB(8);"4 = {SHFT B}ALANCE {SHFT I}N
     QUIRY"
1125 PRINT : PRINT TAB(8);"5 = {SHFT B}UDGET {SHFT A}NA
     LYSIS"
113Ø PRINT : PRINT TAB(8);"6 = {SHFT Q}UIT"
114Ø PRINT "{4 CRSR DNs}{11 SPACEs}{SHFT E}NTER OPTION"
     ; : INPUT OP
116Ø IF OP = 6 THEN CLOSE 15:CLOSE 5:GOTO 99ØØ
118Ø IF OP < 1 OR OP > 5 THEN 1ØØØ
12ØØ ON OP GOSUB 2ØØØ,25ØØ,3ØØØ,43ØØ,45ØØ
122Ø GOTO 1ØØØ
2ØØØ IF LINES + 1 > MAXSIZE THEN RETURN
2Ø1Ø PRINT CLSCREEN$;"{CTRL 9}{SHFT T}RANSACTION {SHFT
     N}UMBER: ";LINES + 1;"{CTRL Ø}"
2Ø2Ø PRINT "{CRSR DN}{CTRL 9}{SHFT D}ATE .........{CTRL
      Ø}"
2Ø3Ø PRINT "{CTRL 9}{14 SPACEs}{CTRL Ø}"
2Ø4Ø PRINT "{CTRL 9}{SHFT B}UDGET {SHFT C}AT ...{CTRL Ø
     }"
2Ø5Ø PRINT "{CTRL 9}{14 SPACEs}{CTRL Ø}"
2Ø6Ø PRINT "{CTRL 9}{SHFT D}ESCRIPTION ..{CTRL Ø}"
2Ø7Ø PRINT "{CTRL 9}{14 SPACEs}{CTRL Ø}"
2Ø8Ø PRINT "{CTRL 9}{SHFT C}HECK {SHFT N}O .....{CTRL Ø
     }"
2Ø9Ø PRINT "{CTRL 9}{14 SPACEs}{CTRL Ø}"
21ØØ PRINT "{CTRL 9}{SHFT C}HECK {SHFT A}MOUNT .{CTRL Ø
     }"
211Ø PRINT "{CTRL 9}{14 SPACEs}{CTRL Ø}"
212Ø PRINT "{CTRL 9}{SHFT D}EPOSIT {SHFT A}MOUNT{CTRL Ø
     }"
213Ø IF DP = 1 THEN RETURN
218Ø IF LINES<>Ø THEN PRINT HOME$;"{2 CRSR DNs}{14 CRSR
      RTs}? ";DT$(LINES)
219Ø PRINT HOME$;"{2 CRSR DNs}{14 CRSR RTs}"; : INPUT E
     $
22ØØ IF E$ = "" OR LEFT$(E$,3) = "END" THEN GOSUB 4ØØØ
     : RETURN
221Ø DT$(LINES + 1) = E$
222Ø LN = 5 : CO = 15 : SZ = 3 : GOSUB 5ØØØ
223Ø IF E$="{COMD @}" THEN E$=""
224Ø BC$(LINES + 1) = E$
225Ø LN = 7 : SZ = 2Ø : GOSUB 5ØØØ
226Ø IF E$="{COMD @}" THEN E$=""
227Ø DS$(LINES + 1) = E$
228Ø LN = 9 : SZ = 4 : GOSUB 5ØØØ
229Ø IF E$="{COMD @}" THEN E$=""
23ØØ CK$(LINES + 1) = E$
231Ø LN = 11 : SZ = 9 : GOSUB 5ØØØ
232Ø IF E$="{COMD @}" THEN E$=""
233Ø CA$(LINES + 1) = E$
234Ø LN = 13 : SZ = 9 : GOSUB 5ØØØ
235Ø IF E$="{COMD @}" THEN E$=""
236Ø DA$(LINES + 1) = E$
24ØØ LINES = LINES + 1
241Ø PRINT"{HOME}{16 CRSR DNs}{SHFT I}S THE ABOVE CORRE
     CT?";
242Ø GET A$ : IF A$<>"Y" AND A$<>"N" THEN 242Ø
243Ø IF A$="N" THEN QN=LINES : EDIT = 1 : GOSUB 254Ø
244Ø EDIT = Ø : GOTO 2ØØØ
25ØØ PRINT CLSCREEN$;"{CTRL 9}{SHFT T}RANSACTION {SHFT
     N}UMBER{CTRL Ø}? Ø{3 CRSR LFs}"; : INPUT QN
251Ø IF QN = Ø THEN GOSUB 4ØØØ : RETURN
252Ø IF QN<Ø OR QN>LINES THEN 25ØØ
253Ø DP = 1 : GOSUB 2Ø2Ø : DP = Ø
254Ø PRINT HOME$;"{2 CRSR DNs}";
```

More

Line 2730—Checks the variable EDIT, which only gets set in the add routine. If it is set, control is returned to the add routine. Otherwise, the program returns to line 2500 to allow you to change more transactions.

Lines 3000-3670—Allow you to print the check register.

Lines 3000-3100—Display a simple menu, offering you the choice of printing on the printer or the screen, or returning to the main menu.

Line 3120—Initializes the line counter to zero and sets the variable, Flag, which signifies that this is the first page.

Line 3140—Checks which option was selected; if you select the screen option, control is transferred to line 3200.

Lines 3160-3180—Display a screen message and open the printer in upper- and lowercase mode.

Lines 3200-3290—They're used by both the printer and screen option.

Line 3200—Sets the initial balance to zero.

Line 3210—Begins a loop through all the transactions.

Lines 3220-3230—Edit the check and deposit amounts for printing.

Line 3240—Checks for the end of the page or screen and jumps to line 3500, if necessary.

Line 3245—Checks the variable Answer$, which may get set to "Q" at the end of the screen routine in line 3540, where you have the option to terminate the screen display.

Line 3250—Updates the new balance by subtracting the check amount and adding the deposit amount of the transaction.

Line 3260—Performs the routine beginning at line 3800, which, for printing purposes, edits the new balance into a variable called NB$.

Lines 3270-3280—Perform routines starting at 3300 or 3400, respectively, to print the transaction.

Line 3290—The end of the loop.

When all transactions have been processed, the printer is closed, if applicable, or else you are asked to press the return key. Then control returns to the main menu.

Lines 3300-3330—Display a single transaction on the screen, and decrement the line counter by two. Each transaction takes two lines to display.

Lines 3400-3470—Print a single transaction on the printer. First, each data item is padded with an appropriate number of spaces and stored in temporary variables A$ through F$, so each item will appear on the report in the correct column. Line 3460 decrements the

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line count by one after printing.

Lines 3500–3670—This is the end of the Page/Screen routine. Line 3500 checks to see if the printer was selected; if so, control is transferred to line 3600. Otherwise, line 3505 checks the variable Flag. If it's set to 1, then this is the first time this routine has been executed, and you don't need to press the return key, so control is returned to line 3240. Line 3510 tells you to press the return key, or to type Q to quit.

If you say to quit, control returns to line 3240. Otherwise, the routine clears the screen, displays the heading, sets the line count to 24 and then returns to line 3240. Lines 3600 through 3670 contain the printer end-of-page routine.

Line 3600—Checks the variable Flag, just like line 3505 does, and bypasses the form feed if it's set. This saves you from wasting a page of paper the first time this routine is executed.

Line 3605—Sends a form-feed command to the printer. If your printer does not support a form-feed command, or if you don't have continuous forms, you'll need to add some appropriate coding here, instead of the form-feed command.

It's a fairly simple matter to emulate a form feed by printing the necessary number of blank lines that will cause the printer to advance to the top of the next page.

Lines 3610–3640—Print the report heading.

Line 3650—Sets the line count to 55.

Line 3660—Sets the variable Answer$ to null. Answer$ can be set to "Q" only in the screen display routine, and it is not applicable in the printer routine. You set it to null here, since line 3245 will check it when you exit this routine.

Lines 3800–3880—This routine takes the value in the variable NBAL and creates a new variable called NB$. Then lines 3810 through 3830 examine NB$, searching for a decimal point. If one is found, control is transferred to line 3850. If one isn't found, then ".00" is appended onto NB$, and then you jump to line 3860. Line 3850 adds an additional 0 to NB$, if necessary. Line 3860 then pads NB$ with spaces to bring its length to nine characters, the correct length for printing purposes.

Lines 4000–4120—This routine saves the transactions onto disk. Line 4030 creates a new, empty file to write to. Lines 4040 through 4060 loop through the transactions and write them to the file.

Lines 4300–4380—Loop through the transactions, subtracting all the check

Listing continued.

```
255Ø PRINT "{14 CRSR RTs}? ";DT$(QN)
256Ø PRINT "{CRSR DN}{14 CRSR RTs}? ";BC$(QN)
257Ø PRINT "{CRSR DN}{14 CRSR RTs}? ";DS$(QN)
258Ø PRINT "{CRSR DN}{14 CRSR RTs}? ";CK$(QN)
259Ø PRINT "{CRSR DN}{14 CRSR RTs}? ";CA$(QN)
26ØØ PRINT "{CRSR DN}{14 CRSR RTs}? ";DA$(QN)
261Ø PRINT HOME$;"{2 CRSR DNs}";
262Ø PRINT"{14 CRSR RTs}"; : INPUT DT$(QN)
263Ø PRINT"{CRSR DN}{14 CRSR RTs}"; : INPUT BC$(QN)
264Ø PRINT"{CRSR DN}{14 CRSR RTs}"; : INPUT DS$(QN)
265Ø PRINT"{CRSR DN}{14 CRSR RTs}"; : INPUT CK$(QN)
266Ø PRINT"{CRSR DN}{14 CRSR RTs}"; : INPUT CA$(QN)
267Ø PRINT"{CRSR DN}{14 CRSR RTs}"; : INPUT DA$(QN)
27ØØ PRINT HOME$;"{16 CRSR DNs}{SHFT I}S THE ABOVE CORR
     ECT?";
271Ø GET A$ : IF A$<>"Y" AND A$<>"N" THEN 271Ø
272Ø IF A$="N" THEN 254Ø
273Ø IF EDIT = 1 THEN RETURN
274Ø GOTO 25ØØ
3ØØØ PRINT CLSCREEN$;"{5 CRSR DNs}"
3Ø2Ø PRINT TAB(1Ø);"S = DISPLAY ON SCREEN"
3Ø3Ø PRINT TAB(1Ø);"P = PRINT ON PRINTER"
3Ø4Ø PRINT TAB(1Ø);"Q = QUIT, RETURN TO MENU"
3Ø5Ø PRINT "{2 CRSR DNs}";TAB(1Ø);"{CTRL 9}{SHFT E}NTER
      YOUR OPTION{CTRL Ø}"; : INPUT SQ$
3Ø8Ø IF SQ$<>"S" AND SQ$<>"P" AND SQ$<>"Q" THEN 3ØØØ
31ØØ IF SQ$="Q" THEN RETURN
312Ø LCNT = Ø : FLAG = 1
313Ø ANSWER$ = ""
314Ø IF SQ$="S" THEN 32ØØ
316Ø PRINT CLSCREEN$;"{5 CRSR DNs}{1Ø SPACEs}{SHFT P}RI
     NT IN {SHFT P}ROGRESS"
318Ø OPEN4,4,7 : CMD4
32ØØ NBAL = Ø
321Ø FOR N=1 TO LINES
322Ø A$=RIGHT$("{1Ø SPACEs}"+CA$(N),9)
323Ø B$=RIGHT$("{1Ø SPACEs}"+DA$(N),9)
324Ø IF LCNT < 5 THEN GOSUB 35ØØ
3245 IF ANSWER$="Q" THEN RETURN
325Ø NBAL = NBAL - VAL(CA$(N)) + VAL(DA$(N))
326Ø GOSUB 38ØØ
327Ø IF SQ$="S" THEN GOSUB 33ØØ
328Ø IF SQ$="P" THEN GOSUB 34ØØ
329Ø NEXT N : IF SQ$="P" THEN PRINT#4," " : CLOSE 4 : R
     ETURN
3292 PRINT "{SHFT P}RESS {SHFT R}{SHFT E}{SHFT T}{SHFT
     U}{SHFT R}{SHFT N}"; : INPUT ANSWER$
3295 RETURN
33ØØ PRINT DT$(N);TAB(9);BC$(N);TAB(13);CK$(N);TAB(18);
     A$;"{3 SPACEs}";B$
331Ø PRINT TAB(5);DS$(N);TAB(3Ø);"{CTRL 9}";NB$;"{CTRL
     Ø}"
332Ø LCNT = LCNT - 2
333Ø RETURN
34ØØ C$ = LEFT$(DT$(N)+"{1Ø SPACEs}",1Ø)
341Ø D$ = LEFT$(BC$(N)+"{5 SPACEs}",5)
342Ø E$ = LEFT$(CK$(N)+"{6 SPACEs}",6)
343Ø F$ = LEFT$(DS$(N)+SPACES$,24)
344Ø PRINT C$;D$;E$;F$;A$;"{2 SPACEs}";B$;"{2 SPACEs}";
     NB$
346Ø LCNT = LCNT - 1
347Ø RETURN
35ØØ IF SQ$="P" THEN GOTO 36ØØ
35Ø5 IF FLAG=1 THEN FLAG=Ø : GOTO 355Ø
351Ø PRINT HOME$;"{22 CRSR DNs}";
352Ø PRINT "{SHFT P}RESS {SHFT R}{SHFT E}{SHFT T}{SHFT
     U}{SHFT R}{SHFT N} OR Q TO QUIT";
353Ø INPUT ANSWER$
354Ø IF ANSWER$ = "Q" THEN RETURN
355Ø PRINT CLSCREEN$;"{CTRL 9}{2 SPACEs}{SHFT D}ATE{3 S
     PACEs}{SHFT C}AT {SHFT C}K #{3 SPACEs}{SHFT A}MOUN
     T{5 SPACEs}{SHFT D}EPOSIT {CTRL Ø}"
```

More

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Listing continued.

```
356Ø LCNT = 24
357Ø RETURN
36ØØ IF FLAG=1 THEN FLAG=Ø : GOTO 361Ø
36Ø5 PRINT CHR$(12) : REM FORM FEED
361Ø PRINT TAB(26);"{SHFT C} {SHFT H}{SHFT SPACE}{SHFT
     E} {SHFT C} {SHFT K}{3 SPACEs}{SHFT R} {SHFT E} {S
     HFT G} {SHFT I} {SHFT S}{SHFT SPACE}{SHFT T}{SHFT
     SPACE}{SHFT E} {SHFT R}"
3615 PRINT " "
362Ø PRINT TAB(2);"{SHFT D}{SHFT A}{SHFT T}{SHFT E}{4 S
     PACEs}{SHFT C}{SHFT A}{SHFT T}{2 SPACEs}{SHFT C}{S
     HFT K} #{2 SPACEs}{SHFT D}{SHFT E}{SHFT S}{SHFT C}
     {SHFT R}{SHFT I}{SHFT P}{SHFT T}{SHFT I}{SHFT O}{S
     HFT N}{13 SPACEs}{SHFT C}{SHFT K} {SHFT A}{SHFT M}
     {SHFT O}{SHFT U}{SHFT N}{SHFT T}{2 SPACEs}";
3625 PRINT "{2 SPACEs}{SHFT D}{SHFT E}{SHFT P}{SHFT O}{
     SHFT S}{SHFT I}{SHFT T}{4 SPACEs}{SHFT B}{SHFT A}{
     SHFT L}{SHFT A}{SHFT N}{SHFT C}{SHFT E}"
363Ø PRINT EQUAL$
364Ø PRINT " "
365Ø LCNT = 55
366Ø ANSWER$ = ""
367Ø RETURN
38ØØ NB$=STR$(INT(NBAL * 1ØØ + .ØØ5) * .Ø1)
381Ø FOR X=1 TO LEN(NB$)
382Ø IF MID$(NB$,X,1)="." THEN P=X : GOTO 385Ø
383Ø NEXT X
384Ø NB$=NB$+".ØØ" : GOTO 386Ø
385Ø IF P=LEN(NB$)-1 THEN NB$=NB$+"Ø"
386Ø NB$ = RIGHT$("{1Ø SPACEs}"+NB$,9)
388Ø RETURN
4ØØØ PRINT CLSCREEN$
4Ø2Ø PRINT "{8 CRSR DNs}{1Ø SPACEs}{SHFT S}AVING, {SHFT
      P}LEASE WAIT"
4Ø3Ø CLOSE 5 : OPEN 5,8,5,"@Ø:"+CFILE$+",S,W"
4Ø4Ø FOR N = 1 TO LINES
4Ø5Ø PRINT#5,DT$(N);CR$;BC$(N);CR$;DS$(N);CR$;CK$(N);CR
     $;CA$(N);CR$;DA$(N)
4Ø6Ø NEXT N
41ØØ CLOSE 5
412Ø RETURN
43ØØ PRINT CLSCREEN$;"{3 CRSR DNs}{2 SPACEs}{SHFT C}OMP
     UTING ... {SHFT P}LEASE WAIT"
431Ø NBAL = Ø
432Ø FOR N{2 SPACEs}= 1 TO LINES
433Ø NBAL = NBAL - VAL(CA$(N)) + VAL(DA$(N))
434Ø NEXT N
435Ø PRINT CLSCREEN$;"{3 CRSR DNs}{2 SPACEs}{SHFT N}EW
     {SHFT B}ALANCE IS ... ";NBAL
436Ø PRINT "{8 CRSR DNs}{2 SPACEs}{SHFT P}RESS {SHFT R}
     {SHFT E}{SHFT T}{SHFT U}{SHFT R}{SHFT N} TO CONTIN
     UE"
437Ø PRINT "{2 SPACEs}"; : INPUTQ$
438Ø RETURN
45ØØ PRINT CLSCREEN$;"{5 CRSR DNs}";TAB(12);"{CTRL 9}{S
     HFT B}UDGET {SHFT A}NALYSIS"
451Ø PRINT TAB(12);"---------------":PRINT
452Ø PRINT TAB(7);"{SHFT E}NTER BUDGET CATEGORY";
453Ø E$="END" : INPUT E$
454Ø IF E$="END" THEN RETURN
455Ø NBAL = Ø : ACCUM = Ø
456Ø PRINT "{3 CRSR DNs}";TAB(9);"{SHFT W}ORKING, PLEAS
     E WAIT."
457Ø FOR N=1 TO LINES
458Ø NBAL = NBAL + VAL(CA$(N))
459Ø IF BC$(N) = E$ THEN ACCUM = ACCUM - VAL(CA$(N)) +
     VAL(DA$(N))
46ØØ NEXT N
461Ø ACCUM = ABS(ACCUM)
462Ø GOSUB 38ØØ
4625 PRINT CLSCREEN$;"{CTRL 9}{SHFT B}UDGET {SHFT A}NAL
     YSIS FOR {SHFT C}ATEGORY ";E$
```

More

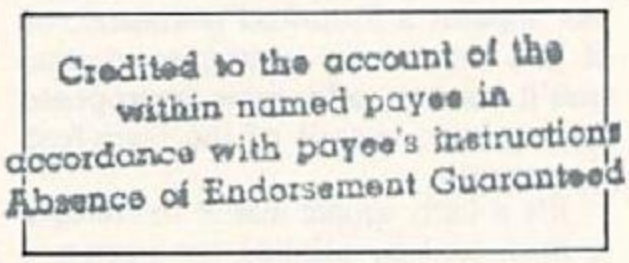
amounts and adding deposits to compute the final balance. The balance is displayed in line 4350.

Lines 4500–4730—Budget analysis routine. This routine prompts you for the budget category you wish to analyze in line 4530. By setting E$ to "end" before the input, the default response is "end." So, if you just press the return key without entering anything, the program knows that you want to quit, and it returns you to the master menu.

Line 4550—Sets NBAL, which will be the total of all checks written, to zero. It also sets ACCUM, the total amount spent in this budget category, to zero.

Lines 4570–4600—Loop through the transactions, accumulating both NBAL and ACCUM.

Line 4610—Removes the negative sign from ACCUM, if there is one. This is so your analysis will contain only positive numbers—numbers that are more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understandable to you. Negative numbers tend to confuse many people.

Lines 4620–4660—Display the total amount of the checks and the budget category amount. The subroutine at line 3800 is called a few times here and there to edit the numbers for display.

Lines 4670–4680—Compute the percentage the budget category represents compared to the total of all checks written for the month, and line 4700 displays it.

Lines 5000–5350—This is a data entry routine that positions the cursor on the screen and displays an underline prompt to show you how large the data item can be. The variable LN represents the line number; CO represents the column number; SZ represents the item size. Line 5180 accepts the data into the variable E$. Lines 5181 through 5185 strip underlines from E$ after it has been entered. Lines 5190 through 5330 clear the space where the underline prompts were displayed; then the data just entered is redisplayed there.

Lines 9900–9920—This is the program exit. The screen is cleared and returns to displaying letters in uppercase.

That's how The Check Manager works, and I hope you, too, will find it to be useful and practical. Happy computing! R

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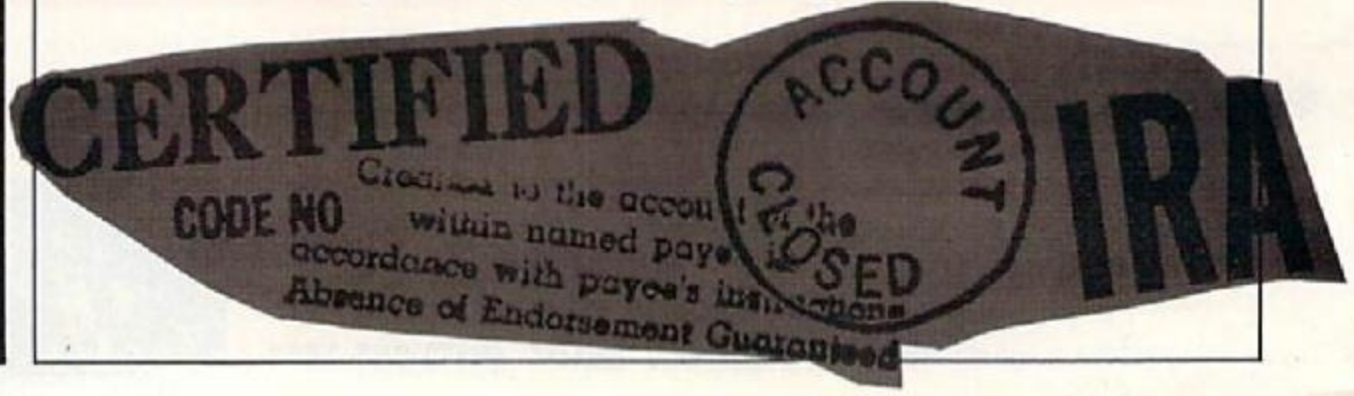
Listing continued.

```
463Ø PRINT "{2 CRSR DNs}{SHFT T}OTAL {SHFT A}LL {SHFT C
     }HECKS ... ";NB$
464Ø SV = NBAL : NBAL = ACCUM : GOSUB 38ØØ
465Ø PRINT "{SHFT C}ATEGORY {SHFT A}MOUNT .... ";NB$
466Ø NBAL = SV
467Ø IF NBAL = Ø THEN PCT = Ø : GOTO 47ØØ
468Ø PCT = INT(ACCUM / NBAL * 1ØØ + .5)
47ØØ PRINT "{CRSR DN}% OF {SHFT A}LL {SHFT C}HECKS ....
      ";PCT;"%"
472Ø PRINT "{14 CRSR DNs}{SHFT P}RESS {SHFT R}{SHFT E}{
     SHFT T}{SHFT U}{SHFT R}{SHFT N}"; : INPUT ANSWER$
473Ø GOTO 45ØØ
5ØØØ PRINT "{HOME}";
5Ø2Ø IF LN = 1 THEN 5Ø5Ø
5Ø3Ø FOR N = 2 TO LN : PRINT "{CRSR DN}"; : NEXT N
5Ø5Ø IF CO = 1 THEN 51ØØ
5Ø6Ø FOR N = 2 TO CO : PRINT "{CRSR RT}"; : NEXT N
51ØØ PRINT "? ";
512Ø FOR N = 1 TO SZ : PRINT "{COMD @}"; : NEXT N
5125 PRINT "{HOME}";
513Ø IF LN = 1 THEN 515Ø
514Ø FOR N = 2 TO LN : PRINT "{CRSR DN}"; : NEXT N
515Ø IF CO = 1 THEN 518Ø
516Ø FOR N = 2 TO CO : PRINT "{CRSR RT}"; : NEXT N
518Ø INPUT E$
5181 I = LEN(E$)
5182 FOR N = I TO 2 STEP -1
5183 IF MID$(E$,N,1) <> "{COMD @}" THEN N = Ø : GOTO 51
     85
5184 E$ = LEFT$(E$,N-1)
5185 NEXT N
519Ø PRINT "{HOME}";
52ØØ IF LN = 1 THEN 522Ø
521Ø FOR N = 2 TO LN : PRINT "{CRSR DN}"; : NEXT N
522Ø IF CO = 1 THEN 525Ø
523Ø FOR N = 2 TO CO : PRINT "{CRSR RT}"; : NEXT N
525Ø PRINT "{2 CRSR RTs}";
526Ø PRINT LEFT$(SPACE$,SZ);
527Ø PRINT "{HOME}";
528Ø IF LN = 1 THEN 53ØØ
529Ø FOR N = 2 TO LN : PRINT "{CRSR DN}"; : NEXT N
53ØØ IF CO = 1 THEN 533Ø
531Ø FOR N = 2 TO CO : PRINT "{CRSR RT}"; : NEXT N
533Ø PRINT "{2 CRSR RTs}";E$
535Ø RETURN
99ØØ PRINT CLSCREEN$;UPPERCASE$
992Ø END
```

CHECK REGISTER

DATE	CAT	CK #	DESCRIPTION	CK AMOUNT	DEPOSIT	BALANCE
02/01/84	bal		Balance Forward		995.68	995.68
02/02/84	rnt	320	XYZ Properties rent	405.00		590.68
02/05/84	utl	321	Electric Bill	65.10		525.58
02/05/84	fod	322	Groceries	34.12		491.46
02/07/84	dep		Paycheck deposit		525.00	1016.46
02/10/84	utl	323	Phone bill	23.55		992.91
02/11/84	clo	324	Shoe store	54.29		938.62
02/14/84	tfs		Transfer to Savings		-100.00	838.62

Fig. 1. Example of check register printout.



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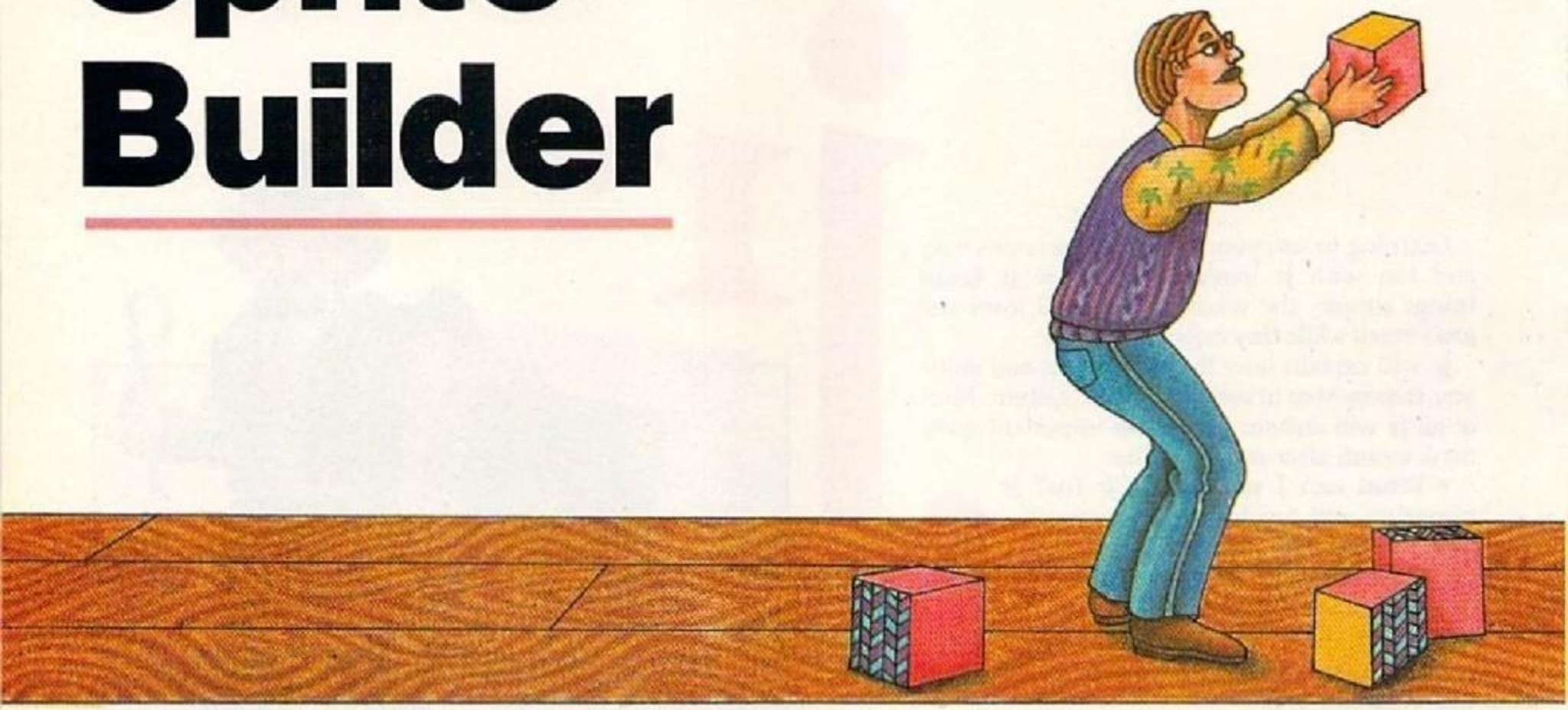

We begin a four-part series on designing your own sprites and using them in your programs. This installment lets you custom-make sprites on the C-64 while you view your creations from all angles and in all possible sizes.

By M. J. Clifford

RUN It Right

Commodore 64
1541 disk drive and joystick optional

Address all author correspondence to M.J. Clifford, 2323 W. Bancroft St., Toledo, OH 43607.

This program helps you to design sprites for the Commodore 64. As you draw the sprite on a large grid, the actual sprite is displayed in all four of its possible sizes—normal, expanded width, expanded height and expanded in both width and height.

Designing the Sprite

You design the sprite by moving a cursor within the large grid by means of the I, J, K and M keys or a joystick. The bits under the cursor are turned on, turned off or left unchanged, depending on the Trace mode and the position of the shift key or firebutton.

When the Trace mode is off, bits can be turned off; when this mode is on, bits can be turned on. The E key toggles the Trace mode on or off. In the keyboard version, the cursor can be moved without affecting any bits if you hold down the shift key; in the joystick version, bits are changed only when you press the firebutton.

To help you to design and edit sprites, the program contains a set of routines to move the sprite within the grid. It can be moved up, down, left or right one row or column. It can also be flipped upside down, turned over left to right or rotated 90 degrees.

Once the sprite is complete, you can save it to disk in a sequential file, which you can later reload for editing or merging with another sprite. The merge option can save time in preparing a symmetrical sprite. When you've completed half the sprite, you can save it on disk, turn it over with option 1 or 2 and then merge it with the saved file to produce the entire sprite.

A program that uses the sprite can load it from the sequential file with a routine similar to lines 3040–3080.

Using the Sprite

Another method of using the sprite in a program is the use of Data statements. When you press the Q key, you're given the option of preparing Data statements. If you respond with a positive answer, the program requests a starting line number and then prints the Data statements on the screen.

To save these lines, either type NEW to remove this program from memory or load the program to which the data

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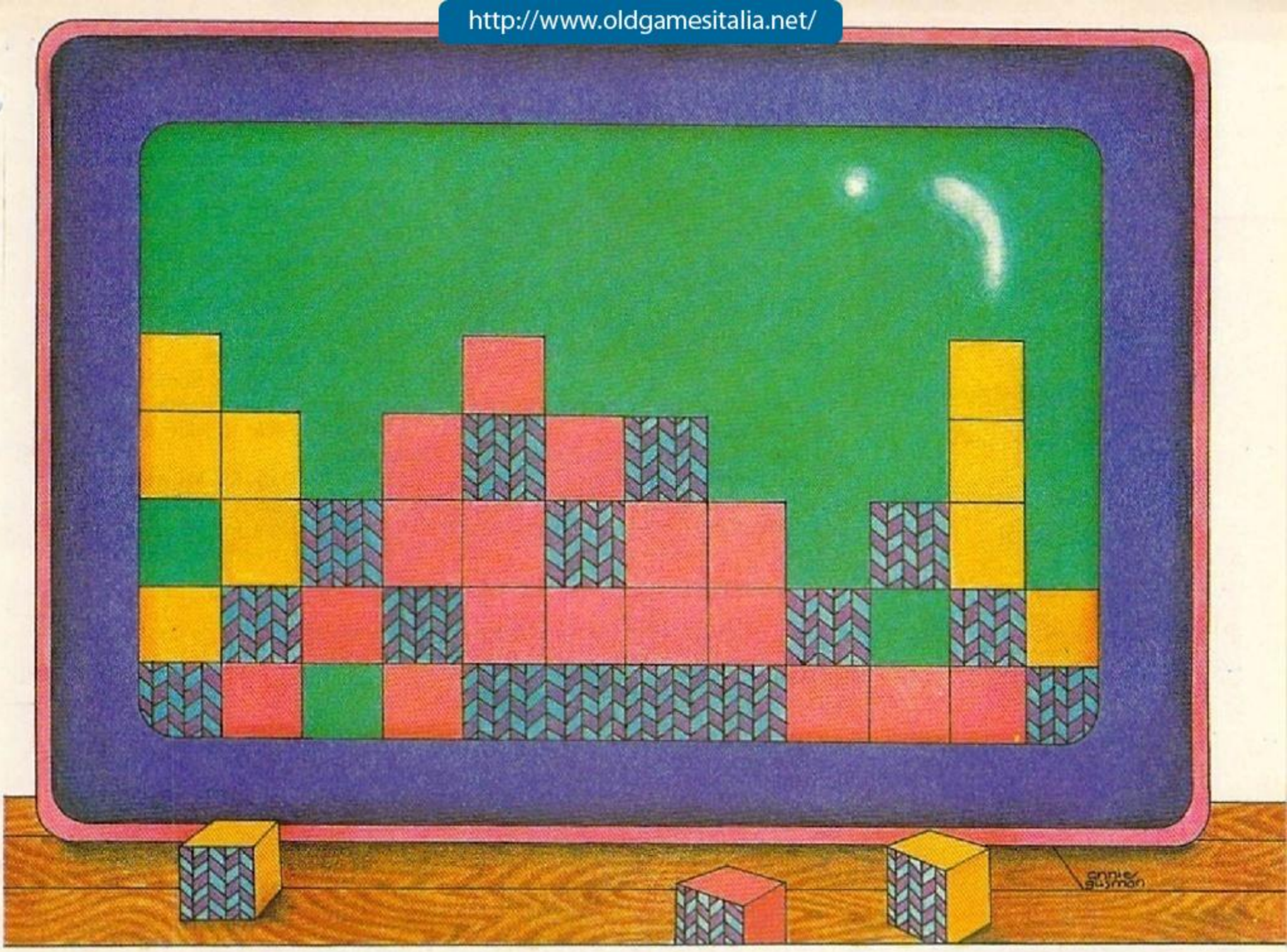

will be added. Then move the cursor to the first line of data and hit the return key seven times. To print out the data after it has been listed on the screen, type "OPEN 4,4:CMD4:GOTO 935".

A menu of special functions is displayed on the screen at all times. Each function is called by pressing a single key. (See the accompanying table for a list of these functions.)

Line for Line

100–350. Keyboard input.

100–110. Calculate the current screen and color locations of the cursor and the corresponding byte and bit of the sprite.

120–130. Flash the cursor and check for keypress.

140. Clears the cursor when key is pressed.

145. If CLR key is pressed, zeroes the sprite and clears the grid.

150–170. Check for function key, shift key and number keys.

180–230. Check for letter keys and update the cursor accordingly.

240. If shift key is pressed, skip bit change.

250–260. If Trace mode is off, erase bit; else, turn bit on.

270–310. Keep cursor within grid.

320–350. Select function based on function key or number key.

360–370. When Trace mode toggled, Poke on/off to the screen.

400–420. Toggle Multicolor mode and Poke Y/N to the screen.

500–570. Input color choices and Poke to the appropriate registers.

580–595. Convert keys 1–8 to values 0–7 or shifted 1–8 to values 8–15.

600–670. Draw four sprite boxes in

1—Turns the sprite upside down.

2—Rotates the sprite around the center line between the twelfth and thirteenth columns. In Multicolor mode, the (01) and (10) colors are swapped, so that the sprite's colors remain the same.

3—Rotates the sprite ninety degrees around the center of the grid. Since there are only 21 rows, the 22nd to the 24th columns are lost.

4—Changes the colors. For color selection, keys 1–8 are used without the control key. The colors normally entered with the C-Logo key are entered as shift 1–8.

5—Toggles the Multicolor mode on and off. The current state is indicated by a Y or N on the screen after the multicolor option in the menu.

6 and 7—Move the sprite left or right one column in Monocolor mode or two columns in Multicolor mode.

8 and 9—Move the sprite up or down one row. With options 6–9, any bits moving off the grid are lost.

E—Toggles the Trace mode on and off.

Q—Ends the program with the option of preparing Data statements.

f1—Saves the sprite data in a sequential file on disk.

f3—Loads a previously saved sprite file.

f5—Merges a previously saved sprite file with the sprite currently on the grid.

SHFT/CLR—Erases the current sprite and clears the grid.

Table. A list of the keys that perform special functions in this program.

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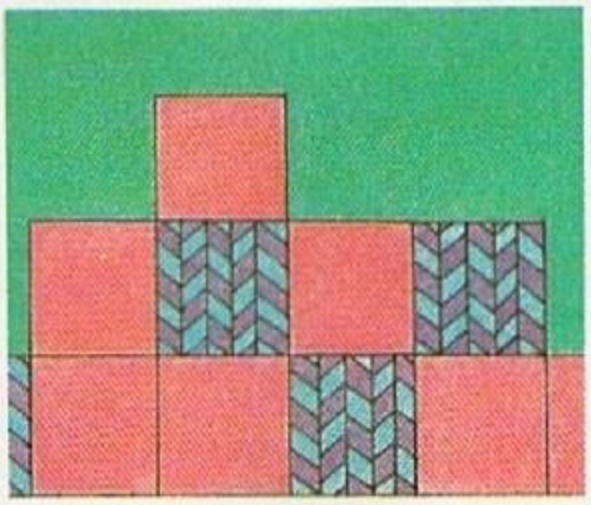

upper left of screen in proper background color.

900–999. Turn off sprites and prepare Data statements; end.

1000–1640. Routines to move sprites.

2000. Saves sprite in a sequential disk file.

2100. Disk error routine.

3000. Loads a sprite file from disk.

4000. Merges a sprite disk file with the current sprite in memory.

5000. Calls machine language routine to copy sprite to the large grid.

5100. Draws the large grid on the screen.

9000. Initializes screen and displays instructions.

9190. Pokes machine language routines into the cassette buffer.

9200. Initializes sprites.

9300. Sets up screen format strings and prints the menu of options.

9340–9350. Pause to allow directions to be read.

9500–9530. Data for ML routine to copy the sprite image to the large grid.

9540–9550. Data for ML routine to invert each byte of sprite for option 2. R

Listing 1. Gain the sprite perspective with this sprite editor program.

```
1 REM
2 REM M.J. CLIFFORD
3 REM 2323 W. BANCROFT ST.
4 REM TOLEDO, OH 43607
10 GOSUB9000
100 SL=SC+40*Y+X:CL=SL+54272
110 BY=Y*3+INT(X/8):BI=7-(X-INT(X/8)*8)
120 POKESL,102+128*CC
130 GETA$:IFA$=""THENCC=1-CC:GOTO120
140 POKESL,160
145 IFA$="{SHFT CLR}"THENFORQ=832TO895:POKEQ,0:NEXT:GOS
    UB5000:GOTO100
150 IFASC(A$)>132ANDASC(A$)<136THEN320
160 K=(ASC(A$)>127):IFKTHENA$=CHR$(ASC(A$)-128)
170 IFVAL(A$)<>0THEN340
180 IFA$="E"THENE=16-E:A$="":GOTO360
190 IFA$="Q"THEN900
200 IFA$="I"THENY=Y-1
210 IFA$="M"THENY=Y+1
220 IFA$="J"THENX=X-1
230 IFA$="K"THENX=X+1
240 IFKGOTO270
250 IFETHENPOKECL,11:Q=PEEK(832+BY):POKE832+BY,QAND(255
    -2{UP ARROW}BI):GOTO270
260 POKECL,1:Q=PEEK(832+BY):POKE832+BY,Q OR 2{UP ARROW}
    BI
270 IFX>23THENX=0:Y=Y+1
280 IFX<0THENX=23:Y=Y-1
290 IFY>20THENY=0
300 IFY<0THENY=20
310 GOTO100
320 ON(ASC(A$)-132)GOSUB2000,3000,4000
330 GOTO100
340 ONVAL(A$)GOSUB1000,1100,1200,500,400,1300,1400,1500
    ,1600
350 GOTO100
360 IFE THEN POKE1912,6:POKE1913,6:GOTO120
370 POKE1912,14:POKE1913,32:GOTO120
399 REM ** MONO/MULTI COLOR **
400 MC=15-MC:POKEV+28,MC
410 POKE1677,14-11*(MC>0)
420 RETURN
499 REM ** COLOR CHANGE **
500 PRINTCL$
510 PRINT"{CRSR UP}BACKGROUND ?":GOSUB 580:BC=I
```

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Listing 1 continued.

```
515 IFMC=0THENPRINT"{CRSR UP}SPRITE COLOR?{3 SPACEs}{3
    CRSR LFs}":GOSUB580:C1=I:GOTO540
520 PRINT"{CRSR UP}UNIQUE C (10)? {CRSR LF}":GOSUB580:C
    1=I
525 PRINT"{CRSR UP}COLOR 1 (01)? {CRSR LF}":GOSUB580:C2
    =I
530 PRINT"{CRSR UP}COLOR 2 (11)?{2 SPACEs}{2 CRSR LFs}"
    :GOSUB580:C3=I
540 GOSUB600
550 PRINTCD$:E=0
555 POKEV+37,C2:POKEV+38,C3
560 FORQ=39TO42:POKEV+Q,C1:NEXT
570 RETURN
580 GETB$:IFB$=""THEN580
585 I=ASC(B$)-25:IFI>15THENI=I-24
590 IFI>=0ANDI<16THENRETURN
595 GOTO580
599 REM ** SPRITE BOXES **
600 PRINTMID$(BG$,BC+1,1);
610 PRINT"{HOME}{CRSR DN}{CRSR RT}{CTRL 9}{5 SPACEs}{CR
    SR RT}{7 SPACEs}"
620 PRINT"{CTRL 9}{CRSR RT}{5 SPACEs}{CRSR RT}{7 SPACEs
    }{CRSR DN}{13 CRSR LFs}{5 SPACEs}{CRSR RT}{7 SPACEs
    }"
630 PRINT
640 PRINT"{CRSR UP}{CRSR RT}{CTRL 9}{5 SPACEs}{CRSR RT}
    {7 SPACEs}{CRSR DN}{13 CRSR LFs}{5 SPACEs}{CRSR RT}
    {7 SPACEs}"
650 PRINT"{CRSR UP}{CRSR RT}{CTRL 9}{5 SPACEs}{CRSR RT}
    {7 SPACEs}{CRSR DN}{13 CRSR LFs}{5 SPACEs}{CRSR RT}
    {7 SPACEs}"
660 PRINT"{CRSR UP}{CRSR RT}{CTRL 9}{5 SPACEs}{CRSR RT}
    {7 SPACEs}{CRSR DN}{13 CRSR LFs}{5 SPACEs}{CRSR RT}
    {7 SPACEs}"
670 PRINTPT$:RETURN
900 POKEV+21,0
910 PRINT"{SHFT CLR}"
920 INPUT"DO YOU WANT THE DATA";Q$:IFLEFT$(Q$,1)<>"Y"TH
    ENEND
925 IFF$=""THENINPUT"NAME FOR SPRITE";F$
930 INPUT"BEGINNING LINE NUMBER";LN
935 PRINT"{SHFT CLR}":PRINTLN;"REM *** SPRITE DATA FOR
    ";F$;" ***":LN=LN+1
940 PRINTLN;"REM *** COLOR:"C1;:IFMC=0THENPRINT" ***":G
    OTO950
945 PRINT","C2","C3"***"
950 LN=LN+1:PRINTLN;"DATA";C1;:IFMC=15THENPRINT",";C2;"
    ,";C3;
955 PRINT:LN=LN+1
960 FORL=0TO3:PRINTLN;"DATA ";
965 FORD=0TO15:PRINTMID$(STR$(PEEK(832+16*L+D)),2);",";
    :NEXTD:PRINT"{CRSR LF} "
970 LN=LN+1:NEXTL
999 END
1000 REM*** ROTATE ON X-AXIS ***
1010 FORZ=832TO859STEP3:ZZ=1724-Z
1020 FORA=0TO2:B=PEEK(Z+A):POKEZ+A,PEEK(ZZ+A):POKEZZ+A,
     B:NEXT:NEXT
1030 GOTO5000
1100 REM*** ROTATE ON Y-AXIS ***
1110 FORZ=832TO892 STEP3
1120 B=PEEK(Z):POKEZ,PEEK(Z+2):POKEZ+2,B:NEXT
1130 SYS 986
1140 IFMC=0THEN5000
1150 A=C1:C1=C2:C2=A:GOTO5000
1200 REM*** ROTATE ON Z-AXIS ***
1210 FOR Z=832 TO 896:POKEZ,0:NEXTZ
1220 FORX=20TO0STEP-1:FORY=0TO20:BY=(20-X)*3+INT(Y/8):B
     I=7-(Y-INT(Y/8)*8)
1230 CL=SC+54272+40*Y+X:IF(PEEK(CL)AND15)<>1THEN1250
1240 A=PEEK(832+BY):POKE 832+BY,AOR2{UP ARROW}BI
1250 NEXTY:NEXTX:X=0:Y=0:MC=0:GOTO5000
1300 REM ** MOVE LEFT **
1305 IFMCTHENGOSUB1310
1310 FORZ=832TO892STEP3
1320 POKEZ,(PEEK(Z)*2-1*(PEEK(Z+1)>127))AND255
1330 POKEZ+1,(PEEK(Z+1)*2-1*(PEEK(Z+2)>127))AND255
1340 POKEZ+2,(PEEK(Z+2)*2)AND255
1350 NEXT:GOTO5000
1400 REM ** MOVE RIGHT **
1405 IFMCTHENGOSUB1410
1410 FORZ=832TO892STEP3
1420 POKEZ+2,PEEK(Z+2)/2+128*(PEEK(Z+1)AND1)
1430 POKEZ+1,PEEK(Z+1)/2+128*(PEEK(Z)AND1)
1440 POKEZ,PEEK(Z)/2
1450 NEXT:GOTO5000
1500 REM ** MOVE UP **
1510 FORZ=832TO891
1520 POKEZ,PEEK(Z+3):NEXT
1530 FORZ=892TO894:POKEZ,0:NEXT
1540 GOTO5000
1600 REM ** MOVE DOWN **
1610 FORZ=894TO835STEP-1
1620 POKEZ,PEEK(Z-3):NEXT
1630 FORZ=832TO834:POKEZ,0:NEXT
1640 GOTO5000
1999 REM ** SAVE SPRITE FILE **
2000 PRINTCL$:PRINTC2$:F$=""
2010 PRINT"{CRSR UP}SAVE IN FILE NAMED";:INPUTF$:IFF$="
     "THEN2080
2020 OPEN1,8,15
2030 FL$="0:"+F$+",SEQ,WRITE"
```

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Listing 1 continued.

```
2040 OPEN2,8,14,FL$
2050 INPUT#1,A,B$,C,D:IFA<>0THEN2100
2060 PRINT#2,F$:PRINT#2,BC:PRINT#2,C1:PRINT#2,C2:PRINT#
     2,C3:PRINT#2,MC
2070 FORM=0TO63:PRINT#2,PEEK(832+M):NEXTM
2080 CLOSE2:CLOSE1
2090 PRINTCL$:PRINTCD$:E=0:RETURN
2099 REM *** DISK ERROR ***
2100 PRINT"{CTRL 9}DISK ERROR{CTRL 0} ";B$:GOTO2080
2999 REM ** LOAD SPRITE FILE **
3000 PRINTCL$:PRINTC2$:F$=""
3010 PRINT"{CRSR UP}LOAD FROM FILE NAMED";:INPUTF$:IFF$
     =""THEN2090
3020 OPEN1,8,15
3030 FL$="0:"+F$+",SEQ,READ"
3040 OPEN2,8,14,FL$
3050 INPUT#1,A,B$,C,D:IFA<>0THEN2100
3060 INPUT#2,F$:INPUT#2,BC:INPUT#2,C1:INPUT#2,C2:INPUT#
     2,C3:INPUT#2,MC
3070 FORM=0TO63:INPUT#2,Q:POKE832+M,Q:NEXTM
3080 CLOSE2:CLOSE1
3090 GOTO5000
3999 REM ** MERGE SPRITE FILE **
4000 PRINTCL$:PRINTC2$:F$=""
4010 PRINT"{CRSR UP}MERGE FROM FILE NAMED";:INPUTF$:IFF
     $=""THEN2090
4020 OPEN1,8,15
4030 FL$="0:"+F$+",SEQ,READ"
4040 OPEN2,8,14,FL$
4050 INPUT#1,A,B$,C,D:IFA<>0THEN2100
4060 INPUT#2,F$:INPUT#2,BC:INPUT#2,C1:INPUT#2,C2:INPUT#
     2,C3:INPUT#2,MC
4070 FORM=0TO63:INPUT#2,Q:POKE832+M,QORPEEK(832+M):NEXT
4080 CLOSE2:CLOSE1
4090 GOTO5000
4999 REM ** DRAW SPRITE IN BIG BOX **
5000 POKEV+28,MC:POKE1677,14-11*(MC>0):GOSUB5100
5010 SYS912:X=0:Y=0:GOTO540
5100 PRINT"{HOME}";:FORY=0TO20
5110 PRINT"{16 CRSR RTs}{CTRL 9}{24 SPACEs}{CTRL 0}";
5120 NEXTY:Y=0
5130 RETURN
9000 POKE53269,0:POKE53281,15:POKE53280,7:PRINT"{COMD 4
     }"
9010 PRINT"{SHFT CLR}{CRSR DN}{13 SPACEs}SPRITE EDITOR{
     CRSR DN}"
9020 PRINT"{5 SPACEs}IN TRACE MODE, THE CURSOR ({COMD +
     })TURNS"
9030 PRINT"ON THE BIT WHEREVER IT MOVES.{2 SPACEs}WHEN
     THE"
9040 PRINT"TRACE IS OFF, THE BIT UNDER THE CURSOR"
9050 PRINT"IS TURNED OR LEFT OFF{CRSR DN}"
9060 PRINT"{4 SPACEs}THE I,J,K,AND M KEYS CONTROL THE"
9070 PRINT"MOVEMENT OF THE CURSOR: I=UP, M=DOWN"
9080 PRINT"J=LEFT, AND K=RIGHT.{2 SPACEs}WITH THE SHIFT
     "
9090 PRINT"KEY DOWN, THE CURSOR CAN BE MOVED"
9100 PRINT"WITHOUT CHANGING ANY BITS.{2 SPACEs}THE CLR
     KEY"
9110 PRINT"CLEARS THE GRID.{CRSR DN}"
9120 PRINT"{2 SPACEs}THE E KEY TURNS THE TRACE MODE ON/
     OFF"
9130 PRINT"AND THE Q KEY ENDS THE PROGRAM WITH THE"
9140 PRINT"OPTION OF PREPARING DATA STATEMENTS."
9150 PRINT"{CRSR DN}{3 SPACEs}TO CHOOSE COLORS, USE KEY
     S 1-8 AS"
9160 PRINT"MARKED AND SHIFT-1 TO SHIFT-8 FOR THE"
9170 PRINT"{CTRL 9}C={CTRL 0} KEY COLORS.{2 SPACEs}A ME
     NU OF OTHER"
9180 PRINT"OPTIONS IS DISPLAYED AT ALL TIMES{CRSR DN}"
9190 FORA=912TO912+101:READB:POKEA,B:NEXT
9200 V=53248:POKE2042,13
9210 POKE2040,13:POKE2041,13:POKE2043,13
9220 FORQ=832TO896:POKEQ,0:NEXT
9230 POKEV+29,10:POKEV+23,12
9240 POKEV,40:POKEV+1,60:POKEV+2,84:POKEV+3,60
9250 POKEV+4,40:POKEV+5,92:POKEV+6,84:POKEV+7,92
9260 POKEV+21,15
9270 C1=2:C2=5:C3=7:BC=1
9280 FORQ=39TO42:POKEV+Q,C1:NEXT
9290 SC=1040:CS=55296:MC=0
9300 CD$="{HOME}{22 CRSR DNs} TRACE=ON{5 SPACEs}E=TRACE
      ON/OFF{3 SPACEs}Q=DONE "
9310 CL$="{HOME}{22 CRSR DNs}{39 SPACEs}"
9320 C2$="{HOME}{23 CRSR DNs}{36 SPACEs}{CRSR UP} "
9330 BG$="{CTRL 1}{CTRL 2}{CTRL 3}{CTRL 4}{CTRL 5}{CTRL
      6}{CTRL 7}{CTRL 8}":PT$="{COMD 4}"
9340 PRINT"HIT A KEY TO START{CRSR UP}"
9350 GETQ$:IFQ$=""THEN9350
9360 PRINT"{SHFT CLR}":GOSUB 5100
9370 PRINT"{HOME}{12 CRSR DNs}{2 CRSR RTs}1-TURN OVER{C
     RSR DN}{11 CRSR LFs}2-MIRROR IMAGE"
9380 PRINT"{2 CRSR RTs}3-ROTATE 90{COMD V}{CRSR DN}{12
     CRSR LFs}4-COLOR CHG{CRSR DN}{11 CRSR LFs}5-MULTIC
     LR"
9390 PRINT"{CRSR UP}{2 CRSR RTs}6-MOVE LEFT {CRSR DN}{1
     2 CRSR LFs}7-MOVE RIGHT{CRSR DN}{12 CRSR LFs}8-MOV
     E UP"
9400 PRINT"{2 CRSR RTs}9-MOVE DOWN"
9410 PRINTCD$:PRINT"{CRSR DN}{CTRL 9}DISK:{CTRL 0} F1=S
     AVE{3 SPACEs}F3=LOAD{3 SPACEs}F5=MERGE{CRSR UP}"
9420 POKE55949,2:POKEV+28,0:POKE1677,14:X=0:Y=0:GOTO600
```

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Listing 1 continued.

```
9500 DATA 169,64,133,248,169,3,133,249,169,16,133,250,1
     69,216,133,251,162,3
9510 DATA 160,0,177,248,10,144,6,72,169,1,145,250,104,2
     00,192,8,208,242,230,248
9520 DATA 202,240,13,165,250,24,105,8,133,250,144,224,2
     30,251,208,220,165,248
9530 DATA 201,127,240,13,165,250,24,105,24,133,250,144,
     203,230,251,208,199,96
9540 DATA 169,63,133,248,169,3,133,249,160,63,162,8,177
     ,248,74,38,250
9550 DATA 202,208,250,165,250,145,248,136,208,239,96
9999 :
10000 REM ** RUN 10000 TO CHECK DATA **
10010 FORX=0TO101:READB:CK=CK+B:NEXTX
10020 IFCK=15921THENPRINT"OK":END
10030 PRINT"{CTRL 9}ERROR IN DATA":END
```

Listing 2. Program line changes to operate with the joystick.

```
1 REM ** CHANGES IN SPRITE EDITOR ***{9 SPACEs}**{2 SPA
  CEs}FOR JOYSTICK OPERATION{2 SPACEs}***
2 :
125 JV=PEEK(56320):FR=16-(JVAND16):JV=15-(JVAND15)
127 IFJV OR FR THEN 140
160 :
200 IF JV AND 1 THEN Y=Y-1
210 IF JV AND 2 THEN Y=Y+1
220 IF JV AND 4 THEN X=X-1
230 IF JV AND 8 THEN X=X+1
240 :
250 IF FR AND E THENPOKECL,11:Q=PEEK(832+BY):POKE832+BY
    ,Q AND(255-2{UP ARROW}BI):GOTO270
260 IF FR THEN POKE CL,1:Q=PEEK(832+BY):POKE832+BY,Q OR
    2{UP ARROW}BI
270 IFX>23THENX=0:Y=Y+1:IFY>20THENY=0
280 IFX<0THENX=23:Y=Y-1:IFY<0THENY=20
290 IFY>20THENY=0:X=X+1:IFX>23THENX=0
300 IFY<0THENY=20:X=X-1:IFX<0THENX=23
9020 PRINT"{5 SPACEs}THE JOYSTICK CONTROLS THE MOVEMENT
     OF THE CURSOR{CRSR DN}"
9030 PRINT"{5 SPACEs}WHEN TRACE IS ON, THE FIREBUTTON"
9040 PRINT"TURNS ON THE BIT UNDER THE CURSOR."
9050 PRINT"WHEN TRACE IS OFF, THE FIREBUTTON TURNS"
9060 PRINT"OFF THE BIT UNDER THE CURSOR."
9070 :
9080 :
9090 :
9100 :
9110 PRINT"{CRSR DN}{5 SPACEs}THE {CTRL 9}CLR{CTRL 0} K
     EY CLEARS THE GRID.{CRSR DN}"
```

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Chatterbox

Follow these directions for interfacing synthesizer ICs, and you'll have your computer talking back to you loud and clear.

By Cass R. Lewart

If you find a friendly GOOD MORNING! spoken by your computer more reassuring than a long string of messages appearing on the screen, then this project's for you.

For $20 or less, this project will introduce you to digital speech synthesis and let you interface synthesizer integrated circuits (ICs) to your computer. Depending on your choice of the ICs, you'll be able to either select from a set of 32 specific words and three melodies or make your own words from individual speech sounds.

Speech Synthesis

The three principal methods of digitally synthesizing speech are Pulse Code Modulation (PCM), Linear Predictive Coding (LPC) and speech synthesis from vocal speech sounds, which are called allophones.

PCM is used mainly for telephone transmission, where no intermediate storage of speech samples is needed. Speech is sampled at the rate of 8000 times per second and each sample is encoded into eight bits. The result is high-quality sound, but storage requirements of 64,000 bits for each second of speech make this method impractical for storing any extended vocabularies.

The LPC method was introduced first to the consumer in Speak-and-Spell and similar devices. It predicts a speech sample from a weighted combination of previous samples and requires between 1000 and 2000 bits for each second of speech. Typically, 15–20 words can be stored in a 16K ROM or RAM.

The third method, using speech sound synthesis, has the advantage of providing an unlimited vocabulary, since individual allophones can be con-

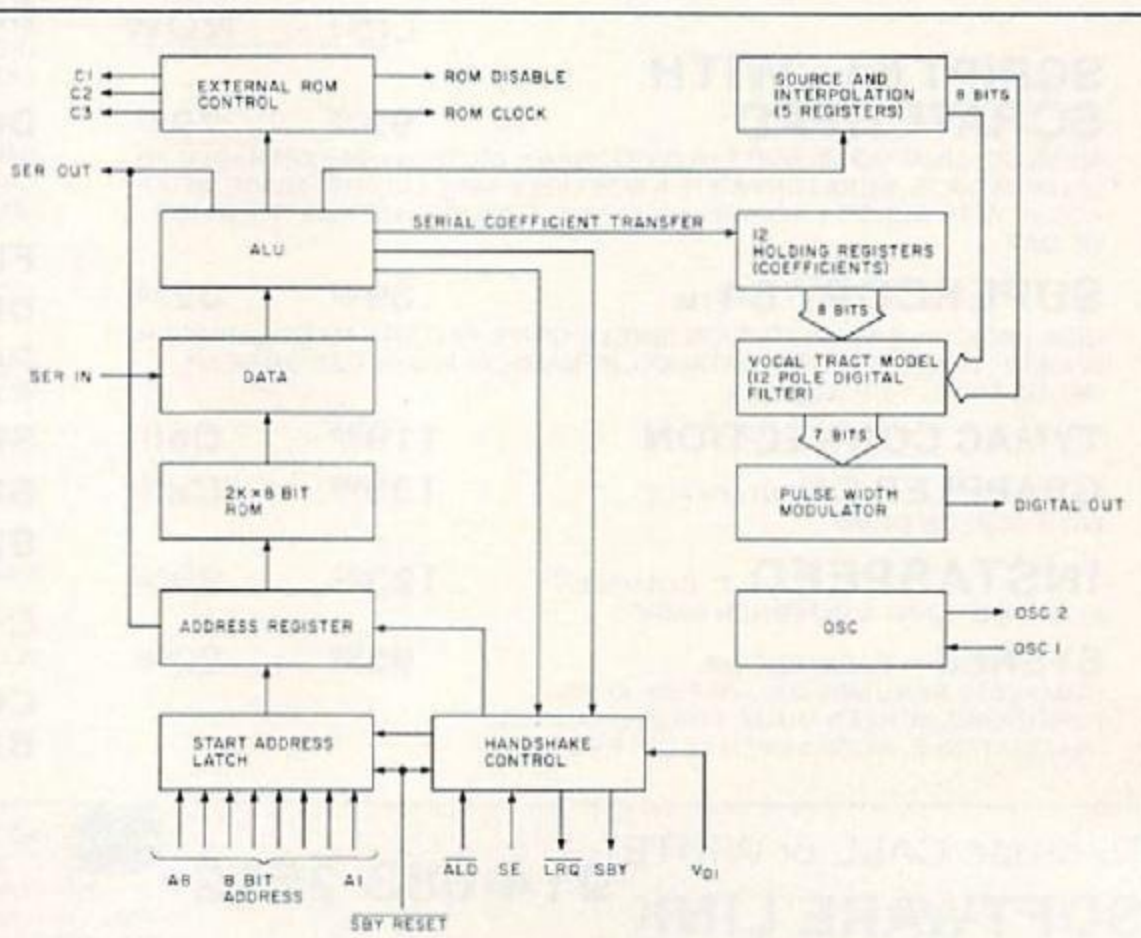

Fig. 1. Components of a large-scale integration chip.

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Commodore 64

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catenated into words. Though the sound quality of this method is not as good as that of PCM or LPC, storage requirements are only 50–100 bits per second of speech. Thus, 300–400 words can be stored in a single 16K memory chip.

In the last few years, much progress has been made in design and in manufacture of speech synthesis ICs. A large scale integration (LSI) chip, which duplicates the vocal tract and consists of tens of thousands of transistors (see Fig. 1), can now be purchased by the hobbyist.

Construction

Follow the schematic diagram in Fig. 2. You have the choice of working with the LPC set of two ICs (SP-0256/SPR-16), featuring a dictionary of thirty-two words and three melodies, shown in Table 1, or with a single SP-0256-AL2 IC, featuring 64 allophones, as listed in Table 2. The SP-0256 and SP-0256-AL2 both use the same pin assignments, so you can use the same circuit to experiment with both kinds of speech synthesis.

When working with LPC, use SP-0256 and SPR-16; when working with allophones, replace SP-0256 with SP-0256-AL2 and remove SPR-16. Radio Shack sells the LPC version of the synthesizer, though the data sheet enclosed with the set of ICs refers to SP-0256-AL2, which is the allophone chip!

Unless you're handy in making a PC board, use point-to-point wiring or wire wrap on a perfboard. As this is a voice frequency project, wiring is not critical. The 3.12 MHz crystal, listed in the parts list (see Table 4), can be obtained from Radio Shack by special order. However, a readily available 3.58 MHz color-burst crystal can be substituted, resulting in a slightly higher voice pitch. A 50-microhenry coil in series with a 100–200 pF capacitor can also be substituted for the crystal. The power supply and the audio amplifier are optional.

When the synthesizer is connected to a computer, you can usually tap +5 Volts (Vdd), and you can use any audio amplifier/speaker combination such as Radio Shack 277-1008, or your hi-fi, as output. Use sockets for the ICs to protect them from heat and to enable you to switch from the LPC to the allophone method by simply plugging in the proper IC. Bring out the lines A1 through A6, Reset, ALD, SBY, GND and Vdd on push-in terminals on the perfboard for testing and subsequent connection to the computer.

You can easily test the circuit in Stand-Alone mode before connecting it to the computer. Set the binary address of the word selected from Table 1 or 2 by connecting the address lines A1 through A6 to either ground (0) or Vdd (1). A1, the least significant digit, counts as 1, A2 as 2, A3 as 4, A4 as 8, A5 as 16 and A6 as 32.

For example, to set the address of "attention please," which is 31 (in binary, 11111), connect A1 through A5 to Vdd (+5 Volt), and A6, the most significant digit, to ground. Next, briefly touch the Reset pin to ground, then touch the ALD pin to ground. If everything works well, "attention please" should sound through your amplifier/speaker system.

The same procedure will generate al-

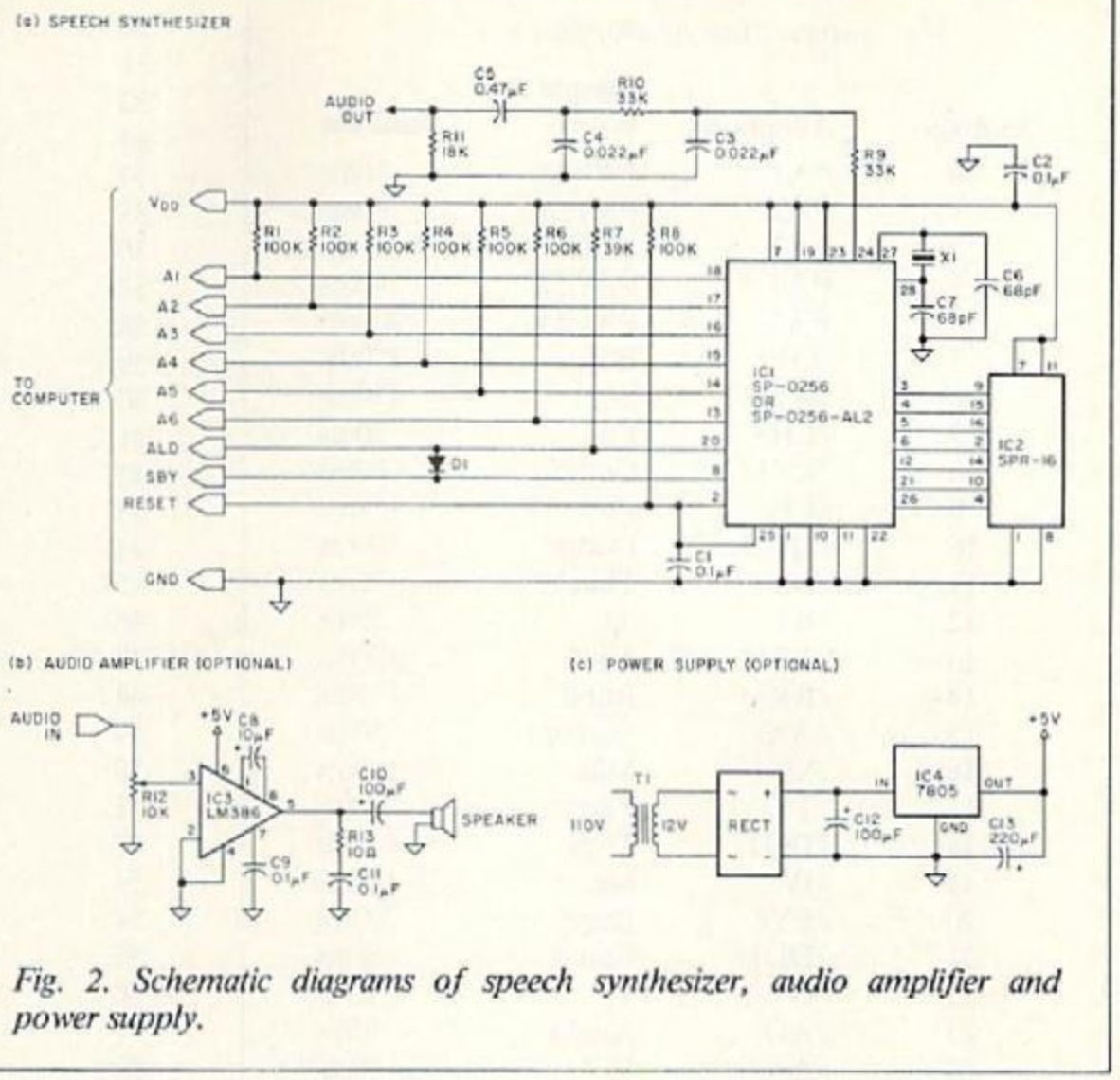

Fig. 2. Schematic diagrams of speech synthesizer, audio amplifier and power supply.

Address	Word	Address	Word
0	Oh	18	Eighteen
1	One	19	Nineteen
2	Two	20	Twenty
3	Three	21	Thirty
4	Four	22	Forty
5	Five	23	Fifty
6	Six	24	It is
7	Seven	25	AM
8	Eight	26	PM
9	Nine	27	Hour
10	Ten	28	Minute
11	Eleven	29	Hundred Hour
12	Twelve	30	Good Morning
13	Thirteen	31	Attention Please
14	Fourteen	32	Please Hurry
15	Fifteen	33	Melody A
16	Sixteen	34	Melody B
17	Seventeen	35	Melody C

Table 1. Vocabulary list.

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Table 2. List of allophones.

Address	Allophone	Sample Word	Duration
0	PA1	PAUSE	10ms
1	PA2	PAUSE	30ms
2	PA3	PAUSE	50ms
3	PA4	PAUSE	100ms
4	PA5	PAUSE	200ms
5	/OY/	Boy	290ms
6	/AY/	Sky	170ms
7	/EH/	End	50ms
8	/KK3/	Comb	80ms
9	/PP/	Pow	150ms
10	/JH/	Dodge	100ms
11	/NN1/	Thin	170ms
12	/IH/	Sit	50ms
13	/TT2/	To	100ms
14	/RR1/	Rural	130ms
15	/AX/	Succeed	50ms
16	/MM/	Milk	180ms
17	/TT1/	Part	80ms
18	/DH1	They	140ms
19	/IY/	See	170ms
20	/EY/	Beige	200ms
21	/DD1/	Could	50ms
22	/UW1/	To	60ms
23	/AO/	Aught	70ms
24	/AA/	Hot	60ms
25	/YY2/	Yes	130ms
26	/AE/	Hat	80ms
27	/HH1/	He	90ms
28	/BB1/	Business	40ms
29	/TH/	Thin	130ms
30	/UH/	Book	70ms
31	/UW2/	Food	170ms
32	/AW/	Out	250ms
33	/DD2/	Do	80ms
34	/GG3/	Wig	120ms
35	/VV/	Vest	130ms
36	/GG1/	Guest	80ms
37	/SH/	Ship	120ms
38	/ZH/	Azure	130ms
39	/RR2/	Brain	80ms
40	/FF/	Food	110ms
41	/KK2/	Sky	140ms
42	/KK1/	Can't	120ms
43	/ZZ/	Zoo	150ms
44	/NG	Anchor	200ms
45	/LL/	Lake	80ms
46	/WW/	Wool	140ms
47	/XR/	Repair	250ms
48	/WH/	Whig	150ms
49	/YY1/	Yes	90ms
50	/CH/	Church	150ms
51	/ER1/	Fir	110ms
52	/ER2/	Fir	210ms
53	/OW/	Beau	170ms
54	/DH2/	They	180ms
55	/SS/	Vest	60ms
56	/NN2/	No	140ms
57	/HH2/	Hoe	130ms
58	/OR/	Store	240ms
59	/AR/	Alarm	200ms
60	/YR/	Clear	250ms
61	/GG2/	Got	80ms
62	/EL/	Saddle	140ms
63	/BB2/	Business	60ms

DD2-AO-TT2-ER1	"daughter"
KK3-AX-LL-AY-DD1	"collide"
SS-SS-IH-SS-TT2-ER1	"sister"
KK1-LL-AW-NN1	"clown"
KK3-UH-KK1-IY	"cookie"
LL-EH-TT2-ER2	"letter"
LL-IH-TT2-EL	"little"
AX-NG-KK3-EL	"uncle"
KK1-AX-MM-PF-YY1-UW1-TT2-ER2	"computer"
EH-KK1-SS-TT2-EH-EH-NN1-TT2	"extent"
TT2-UW2	"two"
AX-LL-AR-MM	"alarm"
SS-KK3-OR	"score"
FF-ER2	"fir"

Table 3. Examples of words made from allophones.

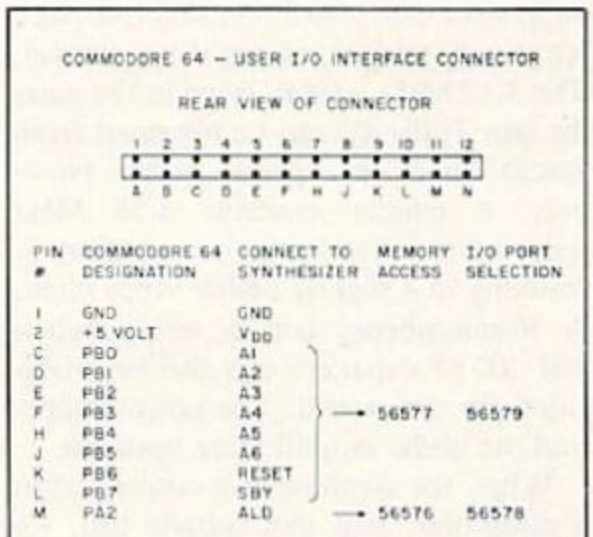
COMMODORE 64 – USER I/O INTERFACE CONNECTOR
REAR VIEW OF CONNECTOR
1 2 3 4 5 6 7 8 9 10 11 12
A B C D E F H J K L M N
PIN # COMMODORE 64 DESIGNATION CONNECT TO SYNTHESIZER MEMORY ACCESS I/O PORT SELECTION
1 GND GND
2 +5 VOLT VDD
C PB0 A1
D PB1 A2
E PB2 A3
F PB3 A4 → 56577 56579
H PB4 A5
J PB5 A6
K PB6 RESET
L PB7 SBY
M PA2 ALD → 56576 56578

Fig. 3. Details of C-64 user I/O interface connector.

Table 4. Parts List.

R1,R2,R3,R4,R5,R6,R8	— 100 kOhm
R7	— 39 kOhm
R9,R10	— 33 kOhm
R11	— 18 kOhm
R12	— 10 kOhm potentiometer
R13	— 10 Ohm

Table 4 continued.

lophones with the SP-0256-AL2 IC, except that each allophone should be followed by another allophone, a pause or a reset at the end of a word. Otherwise, the sound of an allophone will continue.

Computer Interfacing

Now, with the speech-synthesizer circuit working, the real fun begins, name-

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Table 4 continued.

C1,C2,C9,C11	—0.1 MF
C3,C4	—0.022 MF
C5	—.47 MF
C6,C7	—68 pF
C8	—10 MF/10V electrolytic
C10,C12	—100 MF/35V electrolytic
C13	—220 MF/10V electrolytic
D1	—silicon signal diode 1N914 or equivalent
X1	—3.12 crystal (see text)
IC1	—SP-0256 or SP-0256-AL2(see text)
IC2	—SPR-16 (not required with SP-0256-AL2)
IC3	—LM386 (R/S 276-1731 or equivalent)
IC4	—7805 5V regulator (R/S 276-1770 or equivalent)
RECT	—50V/1A bridge rectifier (RS 276-1161 or equivalent)
T1	—12V/1A transformer (R/S 273-1505 or equivalent)

Note: The SP-0256/SPR-16 LPC set of ICs is available from Radio Shack, cat. 276-1783. The SP-0256-AL2 allophone IC is available from C&R Electronics, PO Box 217, Holmdel, NJ 07733, for $18.95 ppd. New Jersey residents add 6% sales tax.

```
10 Y=35:REM UPPER ADDRESS LIMIT FOR LPC CHIP
20 REM USE Y=63 FOR THE ALLOPHONE CHIP
30 POKE 56578,255:REM SET ALD TO OUTPUT
40 POKE 56579,127:REM SET SBY TO INPUT, OTHER PORTS TO OUTPUT
50 POKE 56576,255:REM SET ALD TO READY (+5 V)
60 POKE 56577,0:REM RESET TO GND
70 INPUT X:REM ENTER ADDRESS FROM KEYBOARD
80 IF(X<0 OR X>Y)THEN PRINT"WRONG INPUT":GOTO 70
90 POKE 56577,X+64:REM SET ADDRESSES A1 THROUGH A6
100 POKE 56576,251:REM TRIGGER ALD (SET TO GND)
110 POKE 56576,255:REM RESET ALD (SET TO +5 V)
120 IF PEEK(56577)<128 GOTO 120:REM SENSE SBY FOR +5 V
130 GOTO 60
```

Listing 1. Program to exercise word and allophone capabilities of speech synthesizer.

ly, connecting the circuit to a computer. This article will show you a hardware/software interface for the Commodore 64 and give you some suggestions about interfacing the synthesizer circuit to other computers.

To operate the circuit, you'll need to control the six address lines A1 through A6, Reset and the trigger line ALD. You'll also have to sense the stand-by SBY line, which indicates if the synthesizer has finished "speaking" and is ready for the next word or allophone. Thus, you'll need to connect eight output ports and one input port to your computer.

The C-64 has nine input/output ports on its User I/O connector, located in back of the keyboard, as shown in Fig. 3. By writing (Poking) into memory locations 56576 and 56577, you can set those ports to ground or to +5 Volts. By reading (Peeking) the same locations, you can find the voltage (+5 Volt or ground) at each port.

The C-64 lets you assign each of the nine ports on the User I/O connector as either an input or an output port by writing each of the eight bits associated with a specific port (as shown in Fig. 3) to memory locations 56578 and 56579. A 0 assigns an input port, a 1 an output port. For example, writing 127 (in binary 1111111) to memory location 56579 (POKE 56579,127) will assign port PB7 as input and ports PB0 through PB6 as output from the computer.

Fig. 3 also shows the assignments of the nine synthesizer I/O control lines to the User I/O ports. To complete the interface, connect A1 to pin C on the edge connector, A2 to pin D and so on. If you cannot find a 24-pin edge connector to fit the C-64, get a 44-pin connector (Radio Shack 276-1551 or similar) and file off the excess pins.

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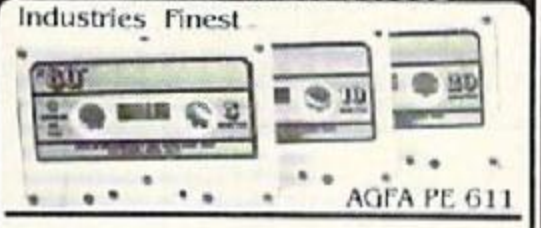

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```
10 Y=63
        ***copy lines 30 through 60 from Listing 1***
70 READ X:REM READ DATA STATEMENTS
        ***copy lines 80 through 120 from listing 1***
130 GOTO 70
140 DATA 4,15,44,8,62,4,55,55,12,55,13,51,4:REM UNCLE,
    SISTER
150 DATA 8,15,45,6,21,4,42,15,16,9,49,22,13,21,14,4:REM
    COLLIDE,COMPUTER
```

Listing 2. Program to generate words from allophones.

```
        ***copy lines 10 through 60 from Listing 1***
70 INPUT A$:REM ENTER A NUMBER (1 DIGIT OR MORE)
71 L=LEN(A$):REM FIND OUT HOW MANY DIGITS
72 FOR K=1 TO L: REM GET ONE DIGIT AT A TIME
73 X=VAL(MID$(A$,K,1))
74 GOSUB 80: REM CALL SYNTHESIZER SUBROUTINE
75 NEXT K:GOTO 70
        ***copy lines 80 through 120 from listing 1***
130 RETURN
```

Listing 3. Program to spell out individual digits of a number.

Interfacing to Other Computers

A number of articles have appeared in this magazine and others about interfacing various computers to the outside world. Many computers, such as KIM-1, Synertek, AIM-65 and VIC-20 have interfacing capabilities similar to the C-64 and come equipped with a user I/O connector.

Other computers, such as the TRS-80 Models 1 through 4, provide a number of decoded input/output ports on the parallel-printer-port connector. If the printer is not in use, then the printer ports can control the speech synthesizer.

Finally, if no decoded ports are available, you can build your own by means of a Peripheral Interface Adapter (PIA) IC, such as 8255 for the Z80 family of microprocessors or 6522 for the 6502 family.

Programming

Three short, self-explanatory programs show the use of the circuit. The program in Listing 1 will generate a word, melody or allophone when the proper address from Table 1 or 2 is entered from the keyboard. The next program (Listing 2) will produce a sequence of words or allophones with their addresses stored in Data statements. The program, using examples from Table 3, will string together several allophones to make words such as "uncle," "sister," "collide" or "computer." The last program (Listing 3) will pronounce individual digits in a number; for example, if you key in 2356, it will say "two—three—five—six." Based on these programs, you could easily develop other applications such as a talking clock or talking calculator. R

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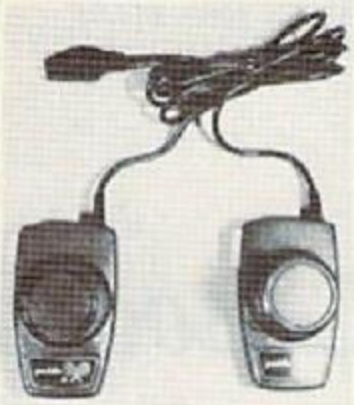

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A space shuttle, carrying 18 astronauts, has collided with an asteroid and drifted into a space minefield. The astronauts ejected from the shuttle, but are floating helplessly in the field.

To fly in and save the astronauts before their air supply runs out is your mission. The mothership is too large to enter the minefield, so you must send the drones to retrieve the astronauts one by one.

Be warned, don't collide with or shoot at the mothership or that'll be the end. Use the docking bay, located at the bottom center of the cruiser, to drop off astronauts. Also, don't hit the mines or you'll lose a drone and possibly an astronaut.

The entire game is seen from the radar screen on the rescue cruiser. The border lines mark how far the drones can go without flying out of radar range. The top left of the screen shows your score and the top right shows how many drones you have left. Use the joystick to steer the drones through the minefield to pick up the astronauts and return them to the mothership.

When you pick up an astronaut, you'll hear a beep. When you return the astronaut to the mothership, you'll hear a lower-pitched tone. If you lose a drone by flying out of radar range or hitting a mine, you'll hear a high-pitched beep, then one of the drone ships on the top right of the screen will disappear. Remember not to pick up more than one astronaut, because the drones can only transport one at a time.

Each drone is equipped with a photon blaster to clear mines. Press the fire button on the joystick to operate the blaster. You can reload by going back to the mothership.

You will have three minutes to rescue the 18 astronauts before they run out of air. At the beginning of play, TI$ is set to "000000." On line 140 in Listing 2,

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Table. What the lines in the Space Rescue program do.

Part One

10	Lowers top of memory
20	Initializes variables
30–120	Title page
130–140	Poke character information above Basic
150	Reseeds random number generator
160–430	Instructions
440	Title page data
450–610	Character information data

Table continued.

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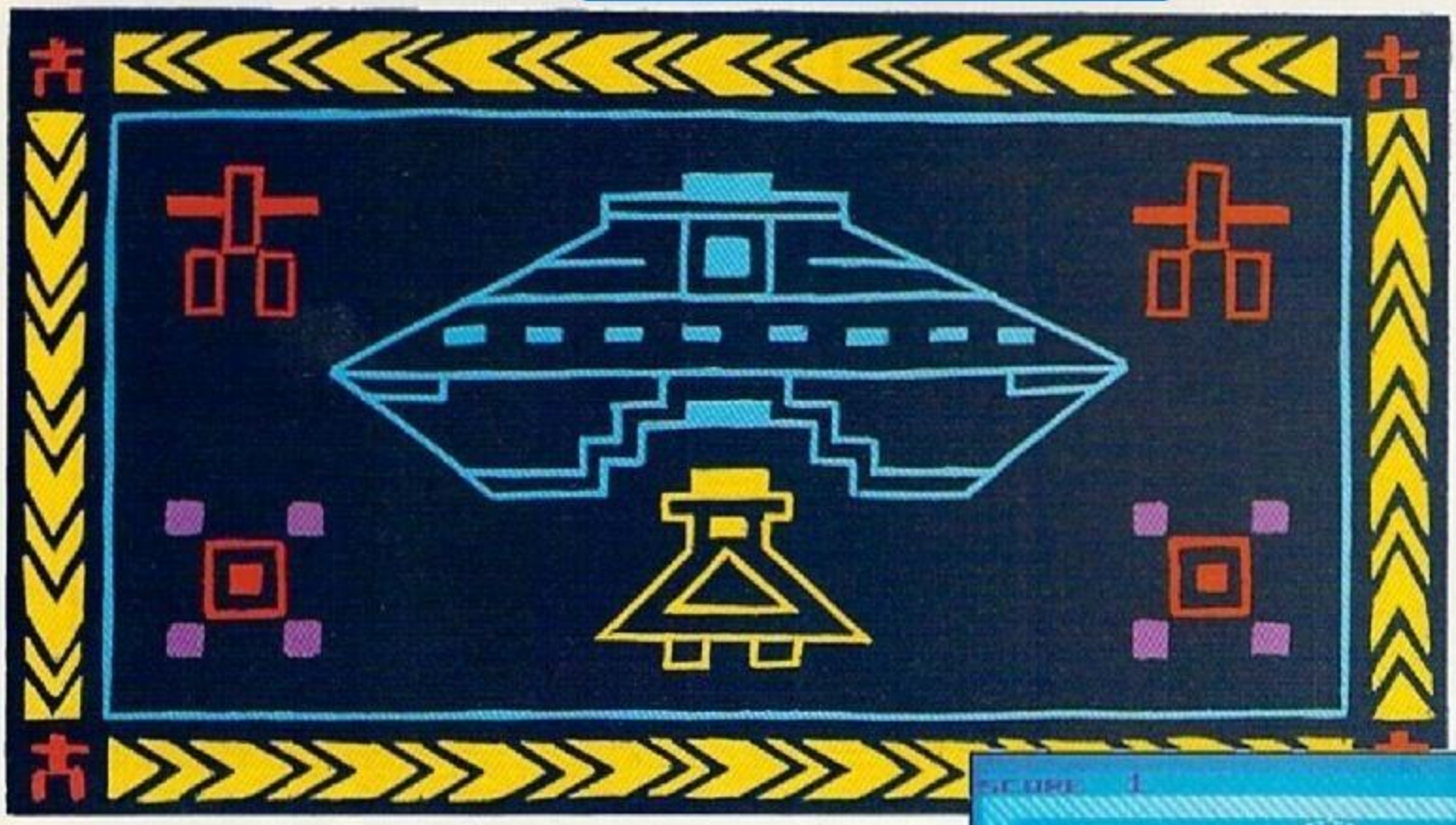

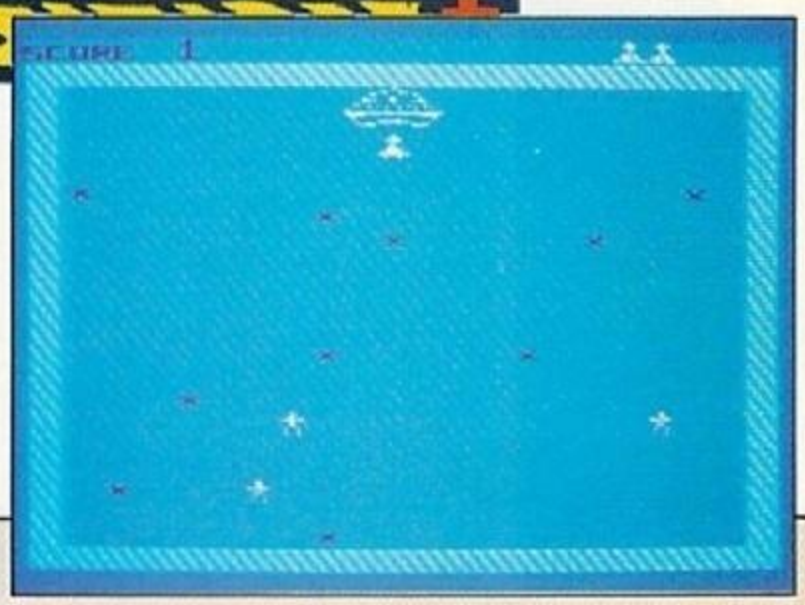

You have only three minutes to rescue the astronauts before they run out of air.

TI$ is checked to see if more than three minutes have passed. If you'd like more time, you can change the number in quotes on line 140.

Before you start playing, the computer will ask you for a skill level, from one to nine. On the first level, you'll receive one point for each astronaut saved. On the ninth level, you'll receive nine points for each astronaut saved. The higher the skill level, the more credits you'll earn for your work. Your skill level also determines how many mines appear on the screen and how many shots your photon blasters can fire between reloadings.

Type in part one and save it onto tape with part two saved immediately after it. In part one, lines 170–390 and 410–420, which are the instructions, can be omitted to save a little typing.

In the first part of this program, the top of memory is lowered, so there's enough room to put programmable characters. If you use a Programmer's Aid while entering this program, make sure you turn the computer off and on before running the game. The Aid raises the top of memory and messes up some of the special characters. If the characters still look strange, check and double-check the data in part one.

Disk users, if you're planning on sav-

Table continued.

Part Two

10–40 . . . . . Initialize variables
50–70 . . . . . Set skill level
90 . . . . . Places border
100 . . . . . Places mines and astronauts
130 . . . . . Reads joystick
140 . . . . . Checks time
150–190 . . . . . Set direction for drone or start firing sequence
200–280 . . . . . Check if drone hit anything
290 . . . . . Moves drone
300–330 . . . . . Explosion routines
340–370 . . . . . Any drones left?
380–410 . . . . . Play again?
420–460 . . . . . Drone docks into mothership
470–480 . . . . . Drone undocks from mothership
490–500 . . . . . Choose random screen locations for mines and astronauts
510 . . . . . Fires shot
520–550 . . . . . Check if shot hit anything
570–580 . . . . . Move shot
610–620 . . . . . "You hit the Mothership!" message
630–660 . . . . . Display score at end of game
670 . . . . . Timer
680–690 . . . . . Mothership appears
700–710 . . . . . Mothership leaves
730 . . . . . Any drones left?
750 . . . . . Timer
790 . . . . . Beep routine
800–810 . . . . . Update score and ships left
820 . . . . . Border data

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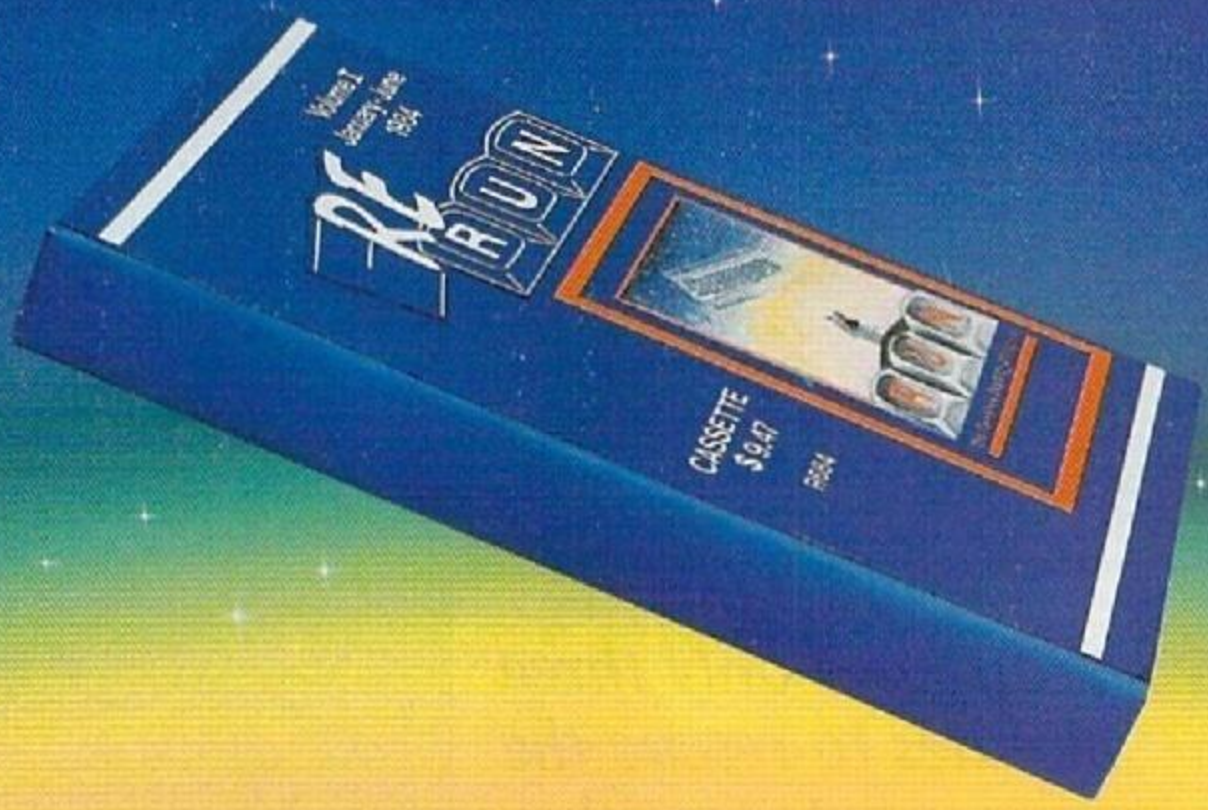

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ing this program on disk, replace line 400 in part one with:

```
400 PRINT CHR$(147)"LOAD"CHR$(34)
"(Program Name)"CHR$(34)",8":POKE198,
2:POKE631,19:POKE632,131
```

For his help at the two or three points where I really got stuck while writing this program, I would like to thank my dad, Dave Gardner.

If you want to avoid the hassle of typing in this program, I'll provide you with a copy if you send me a blank tape, a stamped self-addressed mailer and $3. R

Listing 1. Part 1 of the Space Rescue program.

```
10 POKE52,28:POKE56,28:CLR
20 PRINTCHR$(147)CHR$(158):POKE36879,8:S1=36875:S2=3687
   6:S=210
30 FORJ=1TO5:READA$:N$(J)=A$:NEXT
40 SP$="{22 SPACEs}"
50 G$=CHR$(168)
60 FORJ=1TO5
70 T$=SP$+N$(J)+G$
80 FORI=1TO22
90 PRINTCHR$(19):FORK=1TOJ+5:PRINT:NEXT
100 PRINTMID$(T$,I,22)
110 NEXT:POKES1,S:POKES2,S:FORV=15TO0STEP-1:POKE36878,V
    :NEXT:S=S+2:NEXT
120 FORV=15TO0STEP-.3:POKE36878,V:NEXT:POKES1,0:POKES2,
    0
130 FORI=7168TO7439:READA:POKEI,A:NEXT
140 FORI=7552TO7631:POKEI,PEEK(I+25600):NEXT
150 POKE143,VAL(MID$(TI$,5,2))
160 POKE36879,25:PRINTCHR$(144)CHR$(147)
170 PRINT"YOU HAVE 3 MINUTES TO"
180 PRINT:PRINT"SAVE 18 ASTRONAUTS WHO"
190 PRINT"ARE STRANDED IN A"
200 PRINT:PRINT"SPACE MINEFIELD. PICK"
210 PRINT:PRINT"THEM UP 1 AT A TIME"
220 PRINT:PRINT"AND BRING THEM BACK TO"
230 PRINT"THE MOTHER SHIP."
240 GOSUB400
250 PRINT"THE DRONES HAVE PHOTON"
260 PRINT"BLASTERS TO CLEAR"
270 PRINT:PRINT"MINES. THE SKILL LEVEL"
280 PRINT"YOU CHOOSE DETERMINES"
290 PRINT:PRINT"HOW MANY TIMES YOU"
300 PRINT:PRINT"MAY FIRE. YOU RELOAD"
310 PRINT:PRINT"EACH TIME YOU RETURN"
320 PRINT:PRINT"TO THE MOTHER SHIP."
330 GOSUB400
340 PRINT"BE SURE NOT TO HIT"
350 PRINT:PRINT"ANY MINES OR FLY OUT"
360 PRINT:PRINT"OF RADAR RANGE. USE"
370 PRINT:PRINT"JOYSTICK TO CONTROL"
380 PRINT:PRINT"THE DRONES."
385 GOSUB400
390 POKE198,1:POKE631,131:END
400 PRINT:PRINT:PRINT"{4 SPACEs}(HIT ANY KEY)"
410 GETA$:IFA$=""THEN410
420 PRINTCHR$(147):RETURN
430 DATASPACE,RESCUE,BY,KEN,GARDNER
440 DATA24,24,126,24,24,36,36,36,0,0,36,24,24,36,0,0
450 DATA24,60,24,24,60,126,255,36,36,255,126,60,24,24,6
    0,24
460 DATA64,96,242,127,127,242,96,64,2,6,79,254,254,79,6
    ,2
470 DATA0,0,3,4,15,16,42,64,24,231,0,24,24,0,165,0
480 DATA255,120,32,16,15,0,0,0,255,0,36,255,0,0,0,0
490 DATA0,0,192,32,240,8,84,2,255,30,4,8,240,0,0,0
500 DATA0,0,247,132,244,20,247,0,0,0,189,37,37,37,189,0
    ,0,0,239,40,238,200,47,0
510 DATA153,126,126,255,255,126,126,153,255,0,36,255,60
    ,126,255,36
520 DATA255,0,36,255,0,0,0,24,60,24,24,60,126,255,36,0
```

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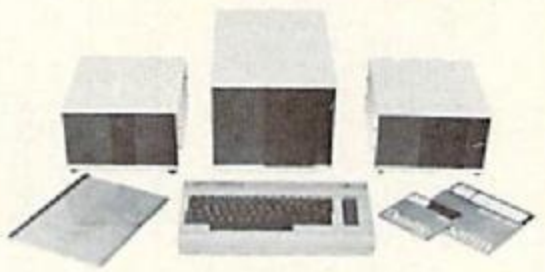

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Listing 1 continued.

```
530 DATA255,0,36,255,0,0,24,60,24,24,60,126,255,36,0,0
540 DATA255,0,36,255,0,24,60,24,24,60,126,255,36,0,0,0
550 DATA255,0,36,255,24,60,24,24,60,126,255,36,0,0,0,0
560 DATA255,0,36,255,60,24,24,60,126,255,36,0,0,0,0,0
570 DATA255,0,36,255,24,24,60,126,255,36,0,0,0,0,0,0
580 DATA255,0,36,255,24,60,126,255,36,0,0,0,0,0,0,0
590 DATA255,255,255,255,255,255,255,255
600 DATA0,0,0,0,0,0,0,0,0,0,24,24,0,0,0
```

Listing 2. Part 2 of the Space Rescue program.

```
10 CC=30720:SH=2:DR=0:S1=36877:VV=36878:AF=0
20 TS=3:DL=7756:SC=0:AC=0:M=6:S=15:R=36869
30 F$="{20 SPACEs}FGJ"
40 K$="{20 SPACEs}HIK"
50 POKE36879,238:PRINTCHR$(144)CHR$(147):PRINT"WHAT SKI
   LL LEVEL? 1-9"
60 GETS$:IFS$=""ORS$<"1"ORS$>"9"THEN60
70 SK=(VAL(S$))*10:TI$="000000"
80 A$=TI$:PRINTCHR$(147):POKER,255:GOSUB800:AZ=3
90 RESTORE:FORH=1TO4:READA,B,C:FORT=ATOBSTEPC:POKET+CC,
   3:POKET,31:NEXT:NEXT
100 FORS=1TOSK:GOSUB490:POKET+CC,0:POKET,1:NEXT:FORAS=1
    TO3:GOSUB490:POKET,0:NEXT:TI$=A$
110 GOSUB680
120 L=7778:GOSUB470
130 POKE37154,127:JY=(NOT((PEEK(37152)AND128)/8+(PEEK(3
    7151)AND60)/4))+32:POKE37154,255
140 IFTI$=>"000300"THENPRINTCHR$(147):PRINT"TIME IS UP.
    .":GOTO630
150 IFJY=1THENDR=-22:SH=2
160 IFJY=2THENDR=22:SH=3
170 IFJY=4THENDR=-1:SH=5
180 IFJY=16THENDR=1:SH=4
190 IFJY=8ANDDR<>0ANDPH<>0THENGOSUB510:IFGR=1THENGR=0:G
    OTO610
200 SL=PEEK(L+DR):IFL=7778ANDDR=-22THENGOSUB420:IFGR=1T
    HENGR=0:GOTO700
210 IFGR=2THENGR=0:GOTO590
220 IFSL=>6ANDSL<=11ANDSL<>9THENGOSUB300:GOTO780
230 IFSL=1ANDAF=1THENAZ=AZ-1:AF=0:GOSUB300:GOTO340
240 IFSL=1THENGOSUB300:GOTO340
250 IFSL=0ANDAF=1THENAZ=AZ-1
260 IFSL=0THENAF=1:POKE7690,0:N=220:GOSUB790
270 IFSL=31ANDAF=1THENPOKEL,32:AZ=AZ-1:AF=0:GOTO350
280 IFSL=31THENPOKEL,32:GOTO350
290 POKEL,32:POKEL+DR,SH:L=L+DR:POKEDL,9:GOTO130
300 POKEL,32:POKEL+DR+CC,2:POKEL+DR,15
310 A=132:FORV=15TO0STEP-.2:POKES1,A:POKEVV,V:A=A-.01:N
    EXT:POKES1,0:RETURN
320 POKEZ+DR+CC,2:POKEZ+DR,15:POKEZ+DR+CC,1:POKEZ+DR,32
    :POKES1,128
330 FORT=15TO0STEP-.5:POKEVV,T:NEXT:POKES1,0:RETURN
340 POKEL+DR,32:POKEL+DR+CC,1
350 TS=TS-1:IFTS<>0ANDAZ<>0THEN770
360 IFTS<>0THEN700
370 PRINTCHR$(147):GOTO630
380 GOSUB670:POKER,240:PRINTCHR$(147):PRINT"PLAY AGAIN?
    Y/N"
390 GETS$:IFS$=""THEN390
400 IFS$<>"N"THEN10
410 END
420 POKEDL,9:POKEDL+22,2:GOSUB750
430 DP=17:POKEVV,0:FORD=1TO7:POKEDL,DP:DP=DP+1:POKEDL+2
    2,DP:GOSUB750:DP=DP+1:NEXT
440 POKEDL,16:POKEDL+22,32:GOSUB750:GOSUB750
450 POKE7690,32:N=190:GOSUB790:IFAZ=0THENGR=1:RETURN
460 IFAF=1THENAF=0:AZ=AZ-1:AC=AC+1:SC=SC+(VAL(S$)):GR=2
    :RETURN
470 DP=30:FORD=1TO7:POKEDL+22,DP:DP=DP-1:POKEDL,DP:GOSU
    B750:DP=DP-1:NEXT:DR=0:PH=SK/10
480 RETURN
490 T=INT(RND(1)*350)+7813:IFPEEK(T)<>32THEN490
500 RETURN
510 POKEVV,S:Z=L:PH=PH-1:FORB=1TO3:POKES1,230:G=PEEK(Z+
    DR):IFG=32THEN570
520 IFG=31THENB=3:GOTO580
530 IFG=0THENAZ=AZ-1:B=3
540 IFG=>6ANDG<=11THENGOSUB560:B=3:GR=1:RETURN
550 IFG=1THENGOSUB560:B=3:GOTO580
560 GOSUB320:GOTO580
570 POKEZ+DR+CC,0:POKEZ+DR,33:FORT=1TO5:NEXT:POKEZ+DR,3
    2:POKEZ+DR+CC,1:Z=Z+DR:NEXT
580 POKES1,0:POKEVV,0:RETURN
590 GOSUB800:IFAZ=0ANDL=7778THEN700
600 GOSUB470:GOTO220
610 POKEZ+DR+CC,1:POKEZ+DR,36:FORT=1TO1000:NEXT:POKER,2
    40
620 PRINTCHR$(147):PRINT"YOU HIT THE MOTHER":PRINT:PRIN
    T"SHIP!!":SC=0:AC=0
630 POKER,240:PRINT:PRINT:PRINT"ASTRONAUTS SAVED:"AC:PR
    INT:PRINT"CREDITS EARNED:"SC
640 IFSC>HSTHENHS=SC
650 PRINT:PRINT"HIGH SCORE:"HS:GOTO380
660 PRINT:PRINT"YOU SAVED ALL THE":PRINT:PRINT"ASTRONAU
    TS!!":GOTO630
670 FORT=1TO4000:NEXT:RETURN
680 FORJ=23TO13STEP-1:GOSUB760
```

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Listing 2 continued.

```
690 PRINTTAB(1)MID$(F$,J,20):PRINTTAB(1)MID$(K$,J,20):G
    OSUB750:NEXT:PRINTCHR$(144)
695 RETURN
700 FORJ=13TO1STEP-1:GOSUB760:GOSUB750:PRINTTAB(1)MID$(
    F$,J,20)
705 PRINTTAB(1)MID$(K$,J,20)
710 NEXT:M=M-1:IFAC=18THENPRINTCHR$(147):GOTO660
720 IFM=0THENPRINTCHR$(147)CHR$(144):GOTO630
730 IFTS<>0THENPRINTCHR$(144):GOTO80
740 PRINTCHR$(147):GOTO630
750 FORT=1TO50:NEXT:RETURN
760 PRINTCHR$(5)CHR$(19):PRINT:RETURN
770 GOSUB800:AF=0:N=240:GOSUB790:GOTO120
780 POKEL+DR+CC,1:POKEL+DR,36:FORT=1TO1000:NEXT:GOTO620

790 POKEVV,S:POKES1-1,N:FORT=1TO25:NEXT:POKES1-1,0:POKE
    VV,0:RETURN
800 FORJ=7680TO7699:POKEJ,32:NEXT:PRINTCHR$(19)"LMN";SC
    :PRINTCHR$(19)TAB(17)
810 FORJ=1TOTS:PRINTCHR$(5)"B";:NEXT:PRINTCHR$(144):RET
    URN
820 DATA7702,7723,1,7723,8185,22,8185,8164,-1,8164,7702
    ,-22
```


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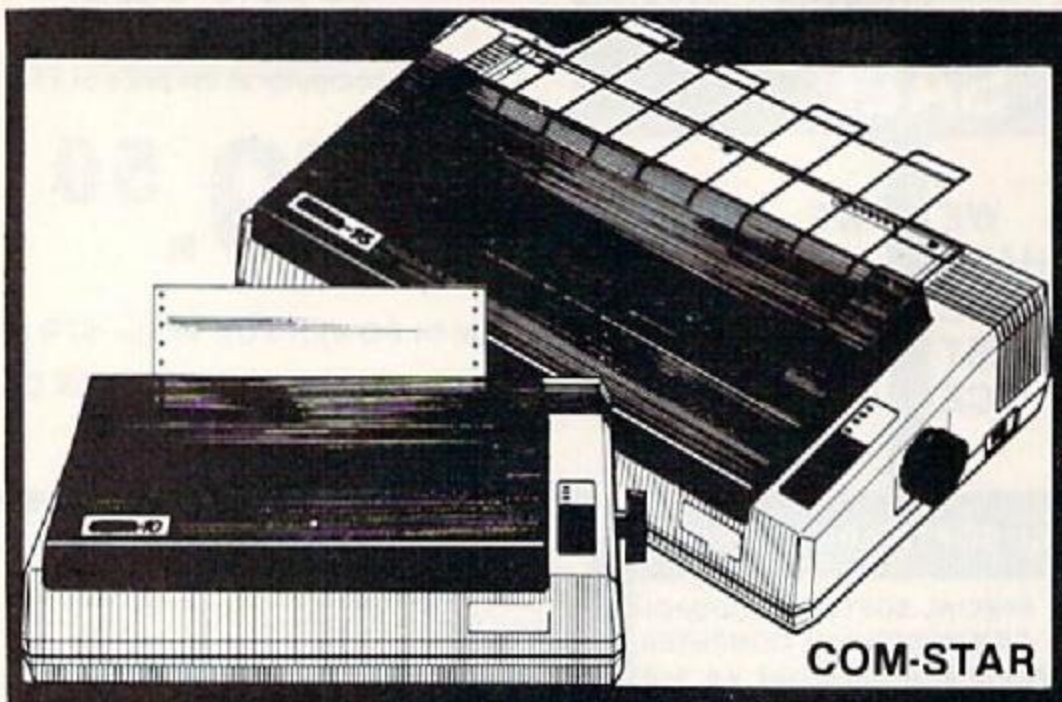

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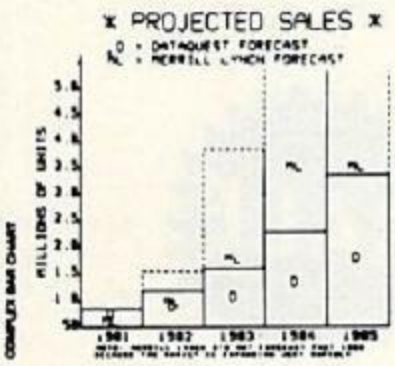

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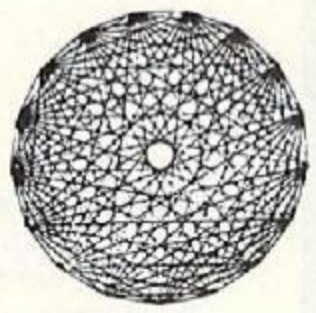

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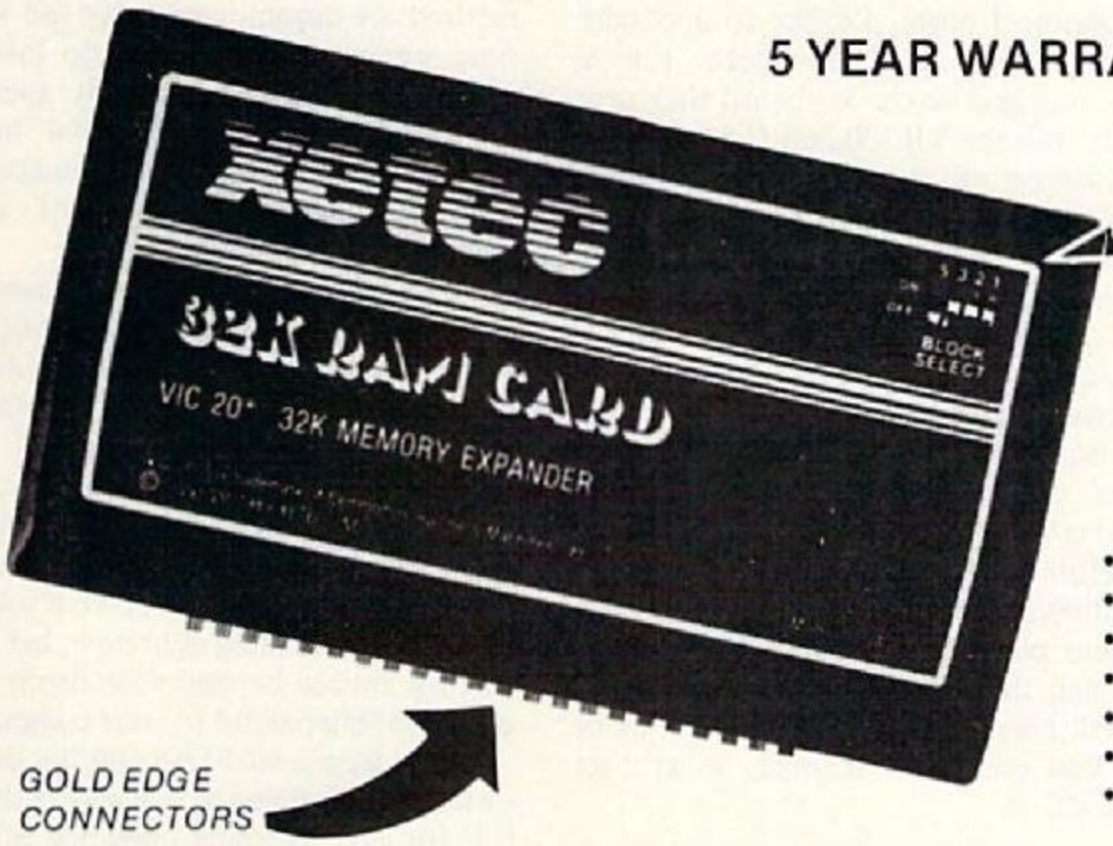

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Custom Keyboard

At Your Fingertips

You can build your own auxiliary keyboard with these instructions. All it takes are enough patience, skill and dexterity.

By John Kula

This article will tell you how to build your own auxiliary keyboard. Although the data is specific to the C-64, the principles are identical for the VIC-20, and should, in fact, be applicable to any microcomputer.

Before I begin, I'd like to apologize to the folks at Commodore. I have nothing against the keyboard they provide with the VIC-20 and C-64. It's like a Checker cab in that it gets you where you want to go...without any chrome, but also without any delays. In fact, considering the precedent that IBM has set in providing their PCjr with a "chicklet" keyboard, I say a nightly prayer of thanks.

But (somehow, you just knew that was coming), there are times when something just a little better would be useful. Perhaps after you've entered endless numbers, you've felt more like a piano player than a programmer, and wished that your computer had a numeric keypad. I'm sure you can think of at least one good rationale, so let's get on with it.

You've Got Two Options

There are basically two ways to add an auxiliary keyboard to a microcomputer. The first method involves connecting the keypad to one of the existing computer ports (such as the joystick port), and loading in a small program.

The program is necessary to help the computer avoid confusion (since this time, what's coming from the joystick port is *not* a joystick) and to decode the signals (microcomputers rarely have the luxury of providing a separate line for each key...more on this later).

The second method involves connecting the keypad directly in parallel with the existing keyboard, and requires no software.

The advantage of the first method is that it's neat, clean and won't void your warranty. The disadvantage is that the program must be in memory before the keypad will work, and should be in machine language so as not to slow down things too much.

The advantages of the second method are instant availability (no software wedges required) and no loss of speed. You may have already guessed the disadvantage...an internal hardware modification that automatically adds 90 days to the age of your machine.

I chose the second method because of its flexibility and the possibilities of future expansion. Also, I prefer to avoid machine language whenever possible.

What You Need

A word or more of caution is in order here. This project will require some skill and patience. If you don't own a soldering gun, stop reading right now, lest you become enticed beyond your depth and do something painful to your computer.

If you have a soldering gun but don't own a soldering pencil, file away this article for later. Nothing I describe will be very difficult to understand, but some of the tolerances are going to be very close, thus precluding ham-handedness.

What's a Keyboard?

A keyboard is nothing more than a collection of switches, with each key representing one switch. Most light switches in the home alternate between being off and on (just like the shift-lock key on the keyboard).

All the other keys on the keyboard control momentary switches, which are on only as long as you hold them down; they turn off as soon as you release them. Thus, when you push down a key, you're allowing a signal to travel through the switch from one point to another.

Most commonly-used switches are

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single-pole, which simply means that the switch is interrupting a single signal (or wire). Don't be confused that there seem to be two wires connected to the switch—it's really only one wire that's been cut so that it can be connected to the switch.

Later in this article, I'll mention double-pole switches; these interrupt two signals at the same time (and have the same effect as does pushing the shift key with another key).

Interpreting the Signals

There are 66 keys on both the C-64 and VIC-20 keyboards. According to what I've already said, you'd think that there would have to be 66 signals (and 66 wires). But don't forget that each key may mean two or more things to the computer, depending on whether you pushed the key by itself, or with the shift, CTRL or Commodore keys.

Actually, up to 256 different signals can be generated by those 66 keys. (The number of permutations and combinations is much higher; the limitation is due to the 8-bit pseudo-ASCII code... $2^8 = 256$. A discussion of why this is so is not necessary to the construction of the keyboard, and would only make life more complicated right now.)

The keyboard really controls a total of 16 signals, and if you look at the schematic diagram in the back of your *Programmer's Reference Guide*, you'll see these labeled as column 0 to column 7, and row 0 to row 7.

How can the computer distinguish up to 256 different characters from only 16 signals? Well, the C-64's CIA/6526 chip (the VIC-20's MPS/6522) receives the signals from the keyboard and decodes them for the computer. It knows that when it detects a signal traveling between column 6 and row 1, someone has pushed the * key.

These signals are labeled "column" and "row" because they correspond to a matrix, and this matrix defines the signals generated by each key. Fig. 1 is the keyboard matrix for the C-64 (the VIC-20 has a different matrix). This is the most important piece of information required for putting together a functional auxiliary keypad.

Here's how the matrix works. Search through the body of the matrix until you find the character you want, say, the f3 key. Note that this key appears at the intersection of column 0 and row 5. Whenever you push the f3 key, a signal travels between column 0 and row 5. Simple, isn't it? Now if a signal had appeared between column 0 and row 4, then the f1 key would have been pushed. That's all there is to it.

ROW	COLUMN 0	1	2	3	4	5	6	7
0:	INST DEL	3	5	7	9	+	£	1
1:	RE-TURN	W	R	Y	I	P	*	←
2:	← CRSR →	A	D	G	J	L	;	CTRL
3:	f7	4	6	8	0	–	CLR HOME	2
4:	f1	Z	C	B	M	.	RT SHFT	SPC
5:	f3	S	F	H	K	:	=	C=
6:	f5	E	T	U	O	@	↑	Q
7:	↑ CRSR ↓	LFT SHFT	X	V	N	,	/	RUN STOP

Fig. 1. Keyboard matrix for the C-64.

The only added complication is that if you had pushed the left shift key (note that it has a different signal from the right shift key, even though they're both labeled "shift" on the keyboard) at the same time as you'd pushed the f3 key, the signal would have been decoded as f4. For simplicity's sake, this isn't indicated on the matrix. I assume that you're familiar with most of the shifted characters.

That's about it for theory and philosophy. Now let's get down to good, hard facts. One of the first things it is necessary for you to do is to decide just exactly what kind of auxiliary keypad you want.

Keypad Shopping

Do you want a simple 10-key numeric keypad, or a 16-key hexadecimal keypad for machine language? Will you have separate cursor-control and function keys? Will you want to incorporate some of the special-function keys used by your favorite word processor or database manager? The answer will be governed in part by keypad availability.

I started with a simple numeric keypad as a testing prototype and ended up with a full 103-key auxiliary keyboard. The principles are the same; only the amount of work differs. I've found that a wide variety of excellent-quality surplus keyboards are available from Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002) at ridiculously low prices (my 103-key Cherry keyboard cost me under $30).

They also stock shielded 25-conductor cable for connecting the keyboard to the computer. (I'm a little uncomfortable about using ribbon cable for this purpose; it's a bit awkward, makes a great antenna and could be prone to cross talk, where signals on one line affect the adjacent lines.)

Don't buy an ASCII keyboard if an unencoded equivalent is available; the latter is cheaper because it has no encoding circuitry, which we don't need anyway. And I recommend buying a true, typewriter-style keypad rather than a membrane or calculator-style.

There are lots of surplus telephone keypads on the market, but they have an unsatisfactory "feel," and the numbers are arranged quite differently from what you're used to on a calculator.

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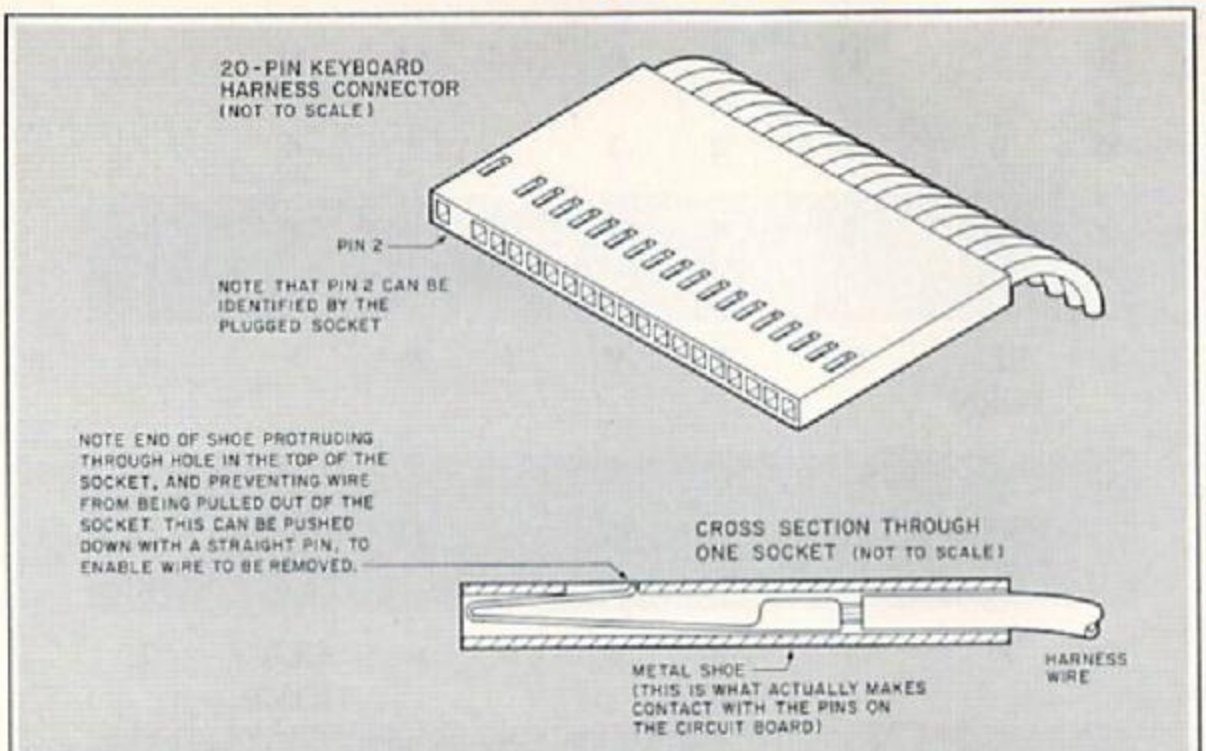
20-PIN KEYBOARD
HARNESS CONNECTOR
(NOT TO SCALE)
PIN 2
NOTE THAT PIN 2 CAN BE IDENTIFIED BY THE PLUGGED SOCKET
NOTE END OF SHOE PROTRUDING THROUGH HOLE IN THE TOP OF THE SOCKET, AND PREVENTING WIRE FROM BEING PULLED OUT OF THE SOCKET. THIS CAN BE PUSHED DOWN WITH A STRAIGHT PIN, TO ENABLE WIRE TO BE REMOVED.
CROSS SECTION THROUGH ONE SOCKET (NOT TO SCALE)
METAL SHOE
(THIS IS WHAT ACTUALLY MAKES CONTACT WITH THE PINS ON THE CIRCUIT BOARD)
HARNESS WIRE

Fig. 2. 20-pin keyboard harness connector.

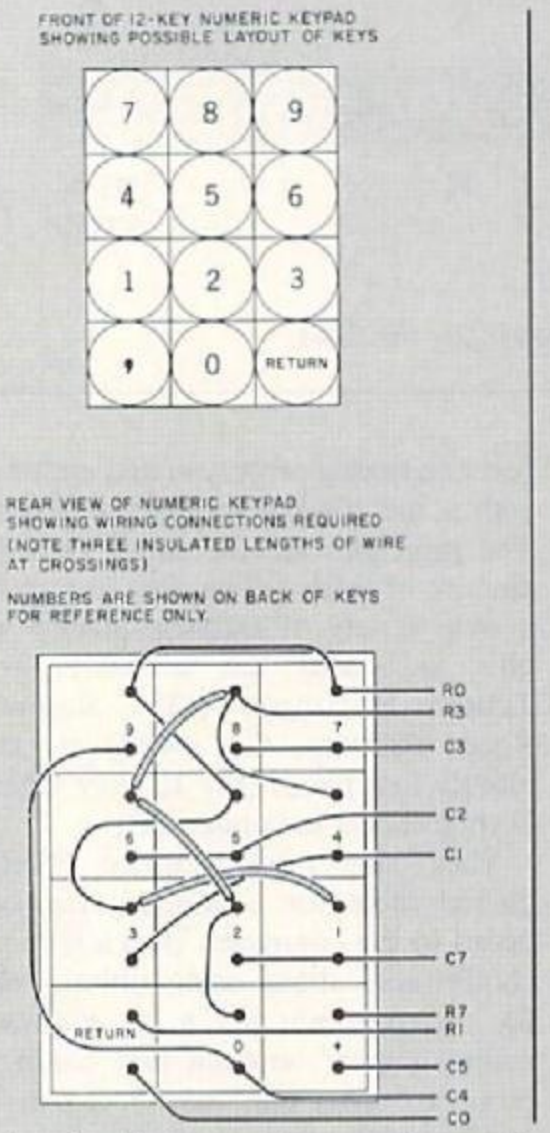

Fig. 3. Front and rear views of numeric keypad.

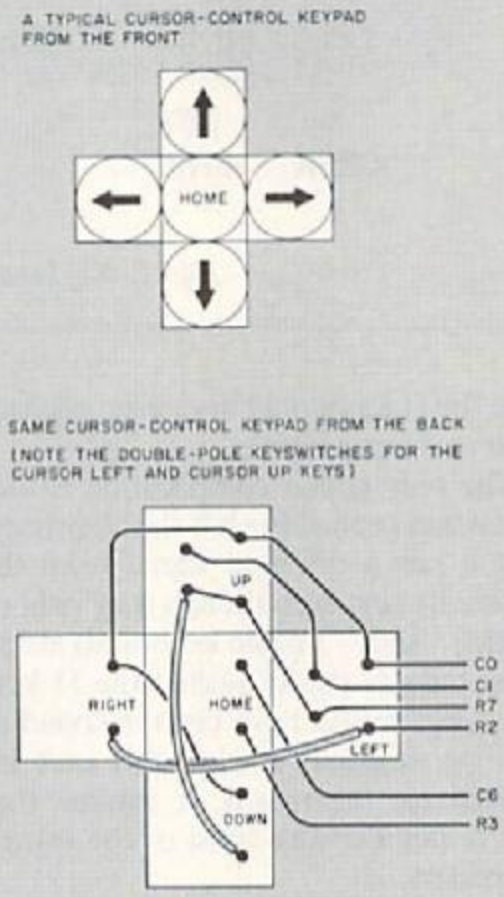

Fig. 4. A typical cursor-control keypad.

Making the Connection

Next, you must decide how you're going to connect the keypad to your computer. You have several options, although they all boil down to making a connection to the keyboard connector. This connector is inside the computer, hidden from prying eyes and fumbling fingers.

After repeatedly opening and closing my computer over a period of time, I chose to install my own keyboard port on the case; but there's nothing wrong with connecting inside and threading the cable through any available aperture to the outside.

Those of you who are experts at cracking the case should move on a few paragraphs and pick up the commentary at that point. Those of you who've yet to see the inside of your computer, take heart—practice makes perfect. Just be sure to first read the instructions, and have them close at hand while you're pulling things apart.

Opening Your Commodore

The C-64 case is composed of two plastic pieces that open up somewhat like a clamshell (but something's wrong if it's as hard for you to open as that little creature).

Observe the usual precautions of turning off the computer and unplugging all accessories. Turn the computer upside down on a clean, soft surface, with the front of the computer toward you. There are three Phillips-type screws along the front edge, which should be nearest to you. Carefully unscrew these with a good screwdriver; a cheap screwdriver or one that's the wrong size will very quickly strip the heads of the screws and cause much future anguish.

At this point, you should be able to pull apart the case at the front. Do it slowly and carefully, as you don't want to lose the screws, which will slip out of their holes, nor do you want to damage the hinging mechanism at the back of the case. You also don't want to tear apart the wires inside that you can't see yet but that are nevertheless going to get in the way.

Better take a break, and contemplate a future with no warranty; if nothing else, this should imbue you with the proper degree of caution and respect.

Looking Inside

The internal wires will be long enough to let you get a good look inside, but not yet long enough to let you lay the two halves of the case down properly. One pair of wires, colored orange and red, connects the little red power-on LED to the circuit board by means of a small plastic connector that can be slipped apart gently. Don't worry about orientation, as the connector will fit back together only one way.

Now it should be possible to manipulate the other wiring harness in such a way that the cases can be fully opened and laid flat. What you see before you are the circuit board screwed into the bottom half of the case and the keyboard screwed into the top half of the case. If the keyboard looks strange, it's because you're looking at its bottom.

The keyboard is connected to the circuit board by an 18-wire harness, attached by means of a simple slip-on connector. Pull this off gently, slowly

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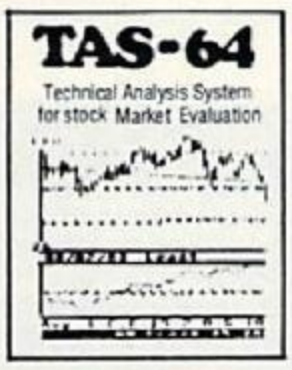

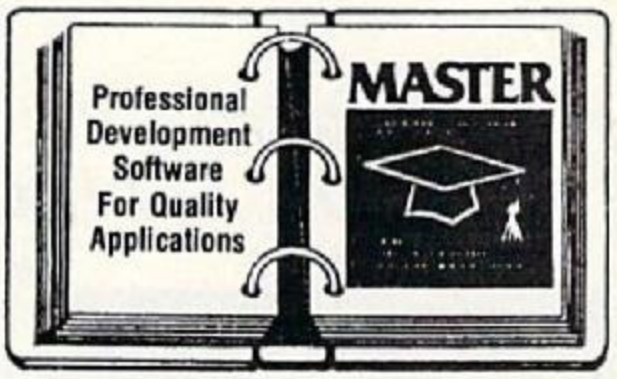

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PIN	C-64	VIC-20
1	Ground	Ground
2	<Orientation Key>	<Orientation Key>
3	Restore	Restore
4	No Connection	+5 Volts
5	Row 3	Column 7
6	Row 6	Column 6
7	Row 5	Column 5
8	Row 4	Column 4
9	Row 7	Column 3
10	Row 2	Column 2
11	Row 1	Column 1
12	Row 0	Column 0
13	Column 0	Row 7
14	Column 6	Row 6
15	Column 5	Row 5
16	Column 4	Row 4
17	Column 3	Row 3
18	Column 2	Row 2
19	Column 1	Row 1
20	Column 7	Row 0

Table 1. Keyboard connector pinout.

and without bending any of the pins.

Again, you needn't worry about which end is up. The female connector, attached to the wires, has an orientation key; this means that one of the holes (number 2, second from one end) is completely filled in, and won't fit onto the pins if you tried to do it backwards. Those 19 pins sticking out of the circuit board are the keyboard connector. We have found the Holy Grail!

Table 1 lists the pins of the keyboard connector and their definitions. It's interesting to note that the restore key has its own signal. The schematic for both the C-64 and the VIC-20 show pin 4 to be +5 volts; the C-64 has no connection to pin 4 (a pity, as the LED might have been connected to this rather than having its own wires) and for all I know it may be the same for the VIC-20.

Notice that one key seems to stick out from the bottom of the keyboard; this is the shift-lock key. As mentioned earlier, it's slightly different from the others in that its action is alternate rather than momentary. This provides a good view of the way most keyswitches look and are connected (in this case, the switch is connected in parallel with the left shift

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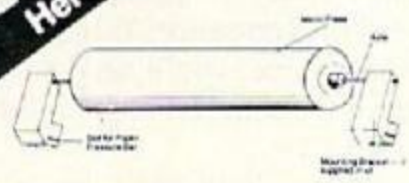

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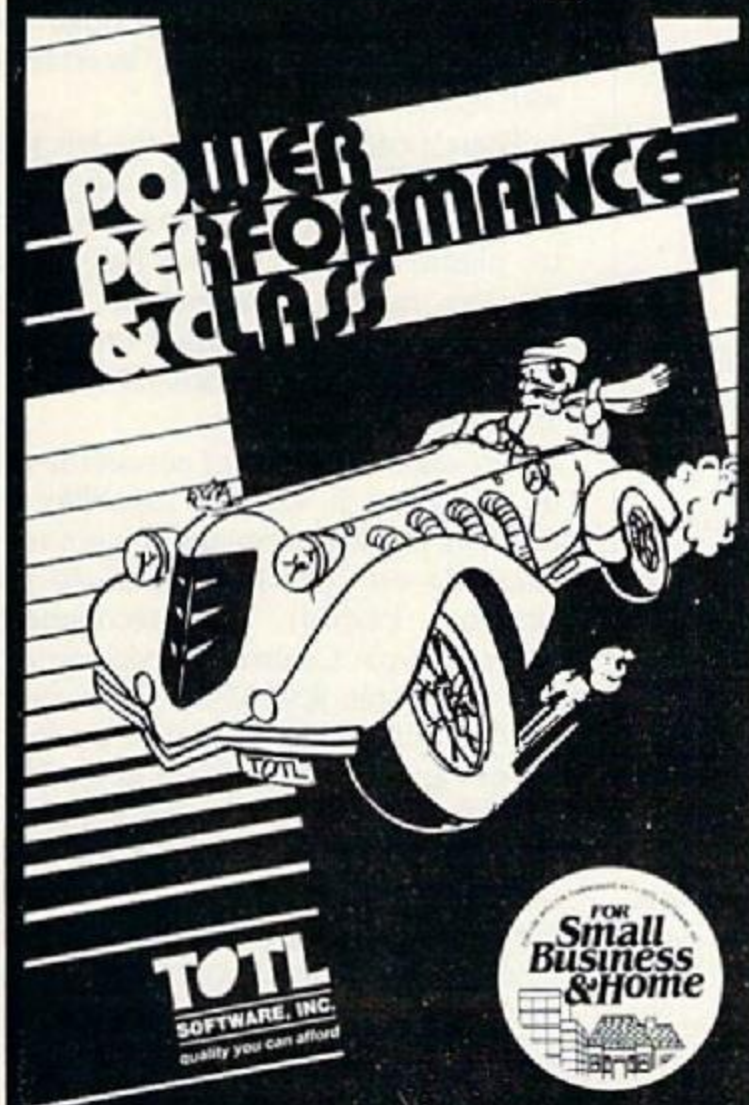

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Parts List

Keypad—one (or more) as per your taste and/or their availability. Try to avoid anything except true typewriter-style keyswitches; beware especially of membrane-type keypads such as the Timex/Sinclair ZX-81 uses.

Cable—a length of 20-conductor ribbon cable or 25-conductor cable, preferably shielded. Determine how far away you'll want the keypad to be from the computer, then order double that amount (it's cheap and you won't regret it).

Connectors—a matched pair (one male and one female) of appropriate connectors. If you use ribbon cable, solderless press-on connectors (such as the Scotchflex system by 3M) will be fine; for normal cable, you'll need solder-tail connectors. Buy the hoods and strain reliefs at the same time. (This is optional but strongly recommended.)

Keyswitches (optional)—get as many double-pole switches as you'll need for your purposes. You'll need two to separate out the cursor controls; four more to separate out f2, f4, f6 and f8, etc. Try to buy ones that match the keyswitches used in your keypad.

Keycaps (optional)—better-quality keypads have removable/replaceable keycaps, which are just a press-fit on the switch. Suppliers like Cherry produce a wide variety of different keycaps in different colors; but sometimes you may have to improvise (and, for example, substitute "Enter" for "Return"). If possible, buy the double-shot keycaps; these have the symbol molded right into the key rather than simply printed on top.

Cabinet—make sure it's wide and long enough to fit your keypad, and also deep enough. Metal is easier to work than plastic, because you can drill and use a "nibbler"; it's also heavier, giving you a firmer, non-slip base. Try to get one with a sloped front to it...10 degrees is comfortable for alphanumeric keys, 30 degrees for numeric or hexadecimal.

Tools Required

Phillips-head screwdriver (for opening the computer case).

Soldering pencil with an ultrafine tip (soldering guns are murderous; soldering irons should be left in the fire).

Rosin-core solder (never, ever use acid-core solder for electronic work).

Solder wick if you have some desoldering to do (one small package will handle about 50 keys).

Wire strippers (there's nothing in the world that will strip the insulation from ribbon cable or 24-gauge wire as quickly and painlessly).

Dykes (these are wire cutters that have the cutting edge flush on one side, so that you can clip off leads extremely close to the circuit board or solder junction) are optional, but versatile.

Straight pin or dentist's probe, if you plan to hard-wire the keypad to the keyboard harness connector as shown in Fig. 2.

Nimble fingers (if you don't have a set of these on the ends of your hands, I'd suggest buying a ready-made keypad from a manufacturer).

key—column 1 and row 7).

Hooking Up to the Connector

How you choose to connect the auxiliary keypad to this connector is a matter of personal choice and comfort. By soldering the wires directly to the female connector, I opted for a hard connection. This entails removing the wires from the connector one at a time and soldering one new wire onto each existing wire. The existing wires are each soldered onto a metal shoe, and this shoe is a push-fit into the connector.

Along one side of the connector is a series of square holes; by pushing into one hole with a pin while tugging on the corresponding wire, the metal shoe with wire will come out intact. No more pressure should be applied to the wire than would be used to tear apart two stamps along the perforation. If you tear the wire out of the shoe, you'll have quite a job ahead of you. Fig. 2 illustrates the technique described.

The more faint-hearted, or conversely, the more gung-ho, would be better advised to obtain a piece of pc (printed circuit) board, which has holes drilled at .100×.100 centers with solder rings around each hole. (For example, Radio Shack item 276-158, cut down just big enough to do the job.) This can be slipped over the male connector (i.e., the pins), and then the keypad wires can be soldered to the pc board.

The advantage of this system is that it may be quickly disconnected if warranty work must be done; the disadvantage is that its connection isn't as positive.

Now that the wire for the auxiliary keypad has been connected, and you've made a note somewhere of which wire is connected to which keyboard connector pin, it's time either to thread the new harness outside the case or to connect this harness to a homemade keyboard port. Regarding the former, ribbon cable can slip through one of the ventilation slots in the bottom of the case; ordinary cable will fit nicely through the user port aperture without interfering with its use.

There's enough room on the left side of the case (viewed from the top front) to install a socket. I cut away some of the plastic from the bottom half of the case by making progressively deeper scores with an X-acto knife until it finally broke through; I then did final sizing and trimming to fit.

Just about any type of connector will do, provided it has the capability of handling at least 16 circuits (it's not necessary to wire pin 1—ground—to the auxiliary keypad). I'd recommend either a 24-pin Centronics-style connector, or a 25-pin RS-232-style connector; they're both widely obtainable, inexpensive and offer oriented mating of the male and female connectors.

To pause for a moment, you may wonder why I'm getting you to bring out all the wires when you may not need them all. A 10-key keypad, for example, requires only seven wires (pins 5,12,16,17,18,19 and 20 for the C-64; pins 5,8,9,10,11,17 and 20 for the VIC-20) to function properly.

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The reason is that you may as well take out all the wires at once, since you never know what you'll decide in the future. Of course, if you're sure that you won't need them all, then by all means, just bring out the wires you need and forget the rest. But don't say I didn't tell you!

Closing Up Commodore

After both of the wiring harnesses have been put back (there's nothing fatal about leaving the LED wires loose; it'll only mean that you won't have an indication of power-on, but you must put back the keyboard harness), the case must be closed and the screws replaced.

Start closing the case by slipping the back edge together; make sure that the plastic prongs slip into the grooves. Then hinge the cases shut. There may be some difficulty in getting the edges to mate properly, particularly around the various ports.

Be sure that the difficulty isn't due to the wires inside binding, or to some foreign object you left behind. The fit isn't perfect, but you should be able to tell by the way it clicks into place and feels solid without wiggling. Only then should you tighten down the screws. And breathe a sigh of relief.

If you're lucky, your keypad will be unwired and you can go on to the next section. Otherwise, you'll have to prepare it for the next stage by removing or disabling any connections between keys.

Wires are relatively easy to remove; clip away the free sections between solder joints, and then desolder the joints with a solder wick. A wick is better than a desoldering pump because it tends to keep some heat away from the joint and the keyswitch.

Wire traces between keyswitches can either be stripped away, or "broken," by gouging channels across them with a sharp knife (if you can persuade your dentist to part with some of his old, surplus tools, they work very well for this sort of thing).

In the worst case, the keypad will have traces on both sides of the circuit board; each keyswitch will have to be desoldered and removed to permit access to both sides. It's not hard, but it's tedious. Your only consolation comes in anticipating the end result.

Rearranging the Keys

The time has now come to rearrange the keypad keys, and to decide if you'd like to include any special keys. For example, your intended use may depend heavily on the function keys; or you may desperately want single-action cursor-control keys. If there's any function you want that is normally obtained by hitting a key in conjunction with the shift key, here's an opportunity to convert it to single action with a double-pole switch.

Double-pole switches have four metal pins, instead of two, at the bottom. Two of them are for the unshifted character; the other two are for the left shifted character. (Before you do any soldering, make sure you know which ones pair up; use a continuity tester for this.)

To give a specific example, if you want to have a single key for the left cursor on the C-64, your double-pole switch should have the following connections: one pair of pins will be connected to column 0/row 2; the other pair will be connected to column 1/row 7. After it's all connected and you're testing out the keypad, if the left cursor key momentarily moves the cursor right before it goes back left, then you're seeing the effect of one of the two circuits in the switch closing briefly before the other.

If this effect bothers you, simply reverse the way the switch is wired; the pair that is wired to the left shift key should now be wired to the cursor control, and vice versa.

Wiring Your Keypad Together

Don't start wiring your keypad together until you're happy with the layout. If you have a 12-key pad, 10 keys are probably for the digits, arranged like a calculator, and one key should be set aside for the return key. So, what do you do with the last one?

If you plan to enter lots of data, a comma would be most useful. On the other hand, if you work with a lot of decimal numbers, you may want the twelfth key to be a period. Or it might be useful to make that last key a space. The point is, think it through before you commit yourself.

The actual job of wiring up each key to the appropriate wire of the harness will go much easier if you've taken some time beforehand to sketch out the various connections you plan to make. Unless you've done it quite often or you're an architect (one of those who have a better grasp of spatial relationships than us mere mortals), you're almost certainly going to make at least one mistake.

Remember that when you look at the back of the keypad, the keys' positions are the mirror image of what they are from the front. Taking one wire of the harness at a time, solder all the connections. Be methodical. Start with all the wires for column 0, then column 1 and so on through to column 7; then do the rows from 0 to 7.

You may be able to connect the first few wires in a daisy chain (strung from each joint to the next without a break), but this only works with bare wire. Eventually, the wires will start to cross each other, and you should have some insulation to protect them from shorting out. Either use insulated wire (the different colors can be an aid in identifying which wires are which) or use spaghetti (rigid insulation, which looks like colored spaghetti and can be slipped over bare wire).

There's no easy solution or shortcut to this process; again, you must be patient. Just keep thinking of the money you're saving and the pleasure you'll get from the new keypad.

A Case for Your Keypad

You don't have to put your keypad into a case, but after all that work, why skimp at the end? A case serves not only to make the keypad attractive and hide the rats' nest of wiring, it also protects from accidental shorting, and a sloped front will make it easier to use.

Before you start cutting the holes for the keys, make a cardboard template. Test it on the bare keypad until you're satisfied with the fit. Then trace it onto the case, and cut away the holes, safe in the knowledge that it will fit perfectly when you're done. It would be a shame to finish off the project with an obviously ill-fitting kludge.

The reason that I kept pushing for some sort of keyboard connector port earlier in this article was because of the flexibility it offers for future projects. Take, for example, the piano keyboard that Commodore has promised to come out with, though I haven't heard very much about it lately. With a keyboard port, or at the very least a set of connectors wired into the cable to the keypad, you could plug in anything you wanted, such as a piano-style keyboard for music.

I've located a supplier of 49-key, piano-style keyboards in England, although I was hoping to find one in North America. At any rate, when I get one, I'll be able to wire it up, plug it into my keyboard port and play music the way it was meant to be played. Maybe I'll buy two and have the same range as a real piano. Hmmmm.... R

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(from p. 27)

```
72Ø R2=PO+1
73Ø C2=COL
74Ø FOR N=1 TO P
75Ø PUZ$(N+PO,COL)=MID$(WRD$,N,1)
76Ø NEXT N
77Ø GOTO 78Ø
78Ø FOR R=1 TO 15
79Ø FOR C1=1 TO 15
8ØØ B=INT(RND(1)*26)+65
81Ø IF PUZ$(R,C1)="" THEN PUZ$(R,C1)=CHR$(B)
82Ø NEXT C1
83Ø NEXT R
84Ø GOTO 94Ø
85Ø PRINT"{SHFT CLR}{CRSR DN}"
86Ø PRINTTAB(6)"{CTRL 3}ABCDEFGHIJKLMNO{CTRL 7}"
87Ø FOR R=1 TO 15
88Ø PRINT"{CTRL 3}":PRINTTAB(2)R;TAB(6)"{CTRL 7}";
89Ø FOR C1=1 TO 15
9ØØ PRINT PUZ$(R,C1);
91Ø NEXT C1
92Ø NEXT R
93Ø RETURN
94Ø GOSUB 85Ø
95Ø PRINT"{CRSR DN}"
96Ø PRINTTAB(1)"ENTER COLUMN (A-O):"
97Ø FI=TI
98Ø GET A$:IF A$="" GOTO 98Ø
99Ø A=ASC(A$)
1ØØØ IF A<65 OR A>79 GOTO 98Ø
1Ø1Ø A=A-64
1Ø2Ø SI=TI
1Ø3Ø PRINTTAB(1)"";
1Ø4Ø INPUT"ENTER ROW (1-15)";RT$
1Ø5Ø RT=VAL(RT$)
1Ø6Ø IF R2=RT AND A=C2 GOTO 118Ø
1Ø7Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
1Ø8Ø PRINTTAB(1)"WRONG.{2 SPACEs}WORD IS IN"
1Ø9Ø PRINTTAB(1)"COLUMN ";CHR$(C2+64);" ROW ";R2"
11ØØ FOR N=1 TO 2ØØØ
111Ø NEXT N
112Ø GOSUB 85Ø
113Ø PRINT"{CRSR DN}"
114Ø PRINTTAB(6)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL Ø}{CT
    RL 7}"
115Ø GET A$:IF A$="" GOTO 115Ø
116Ø PRINT"{SHFT CLR}"
117Ø GOTO 24Ø
118Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
119Ø DF=SI-FI
12ØØ ES=INT(DF/6Ø)
121Ø MIN=INT(ES/6Ø)
122Ø SEC=ES-MIN*6Ø
123Ø IF DF<REC THEN FLAG=1:REC=DF
124Ø PRINTTAB(1)"THAT IS CORRECT."
125Ø PRINTTAB(1)"YOU TOOK JUST"
126Ø PRINTTAB(1)MIN;"MINUTES AND"
127Ø PRINTTAB(1)SEC;"SECONDS !!{3 CRSR DNs}"
128Ø IF FLAG<>1 GOTO 13ØØ
129Ø PRINTTAB(1)"NEW RECORD !!!{2 CRSR DNs}"
13ØØ FLAG=Ø
131Ø PRINTTAB(6)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL 7}"
132Ø GET A$:IF A$="" GOTO 132Ø
133Ø PRINT"{SHFT CLR}"
134Ø GOTO 24Ø
```

Listing 2. Word Search program for the C-64.

```
1Ø REM ***************
2Ø REM *{13 SPACEs}*
3Ø REM * WORD SEARCH *
4Ø REM *{13 SPACEs}*
5Ø REM ***************
6Ø POKE 53281,1
7Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
8Ø PRINTTAB(12)"{CTRL 6}{CTRL 9}WORD SEARCH{CTRL 7}{2 C
   RSR DNs}"
9Ø PRINTTAB(8)"YOU WILL BE SHOWN"
1ØØ PRINTTAB(8)"A WORD.{2 SPACEs}TRY TO "
11Ø PRINTTAB(8)"FIND IT IN PUZZLE AS"
12Ø PRINTTAB(8)"QUICKLY AS YOU CAN.{2 CRSR DNs}"
13Ø PRINTTAB(8)"ENTER ROW, COLUMN OF"
14Ø PRINTTAB(8)"FIRST LETTER OF WORD.{2 CRSR DNs}"
15Ø PRINTTAB(12)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL 7}"
16Ø GET A$:IF A$="" GOTO 16Ø
17Ø PRINT"{SHFT CLR}"
18Ø DIM PUZ$(15,15)
19Ø REC=999999999
2ØØ DATA COMPUTER, KEYBOARD
21Ø DATA COMMODORE,PROGRAM
22Ø DATA DISKETTE,MONITOR
23Ø DATA GRAPHICS,VERIFY
24Ø DATA COMMAND,DIMENSION
25Ø C=INT(RND(1)*4)+1
26Ø FOR R=1 TO 15
27Ø FOR C1=1 TO 15
28Ø PUZ$(R,C1)=""
29Ø NEXT C1
3ØØ NEXT R
31Ø READ WRD$
32Ø PRINT"{SHFT CLR}"
33Ø PRINT WRD$
```

More →

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Listing 2 continued.

```
34Ø ON C GOTO 35Ø,45Ø,57Ø,69Ø
35Ø ROW=INT(RND(1)*15)+1
36Ø P=LEN(WRD$)
37Ø P1=15-P
38Ø PO=INT(RND(1)*P1)
39Ø C2=PO+1
4ØØ R2=ROW
41Ø FOR N=1 TO LEN(WRD$)
42Ø PUZ$(ROW,N+PO)=MID$(WRD$,N,1)
43Ø NEXT N
44Ø GOTO 79Ø
45Ø ROW=INT(RND(1)*15)+1
46Ø P=LEN(WRD$)
47Ø P1=15-P
48Ø PO=INT(RND(1)*P1)
49Ø C2=PO+P
5ØØ R2=ROW
51Ø FOR N=P TO 1 STEP-1
52Ø CU=CU+1
53Ø PUZ$(ROW,N+PO)=MID$(WRD$,CU,1)
54Ø NEXT N
55Ø CU=Ø
56Ø GOTO 79Ø
57Ø COL=INT(RND(1)*15)+1
58Ø P=LEN(WRD$)
59Ø P1=15-P
6ØØ PO=INT(RND(1)*P1)
61Ø R2=PO+P
62Ø C2=COL
63Ø FOR N=P TO 1 STEP-1
64Ø CU=CU+1
65Ø PUZ$(N+PO,COL)=MID$(WRD$,CU,1)
66Ø NEXT N
67Ø CU=Ø
68Ø GOTO 79Ø
69Ø COL=INT(RND(1)*15)+1
7ØØ P=LEN(WRD$)
71Ø P1=15-P
72Ø PO=INT(RND(1)*P1)
73Ø R2=PO+1
74Ø C2=COL
75Ø FOR N=1 TO P
76Ø PUZ$(N+PO,COL)=MID$(WRD$,N,1)
77Ø NEXT N
78Ø GOTO 79Ø
79Ø FOR R=1 TO 15
8ØØ FOR C1=1 TO 15
81Ø B=INT(RND(1)*26)+65
82Ø IF PUZ$(R,C1)="" THEN PUZ$(R,C1)=CHR$(B)
83Ø NEXT C1
84Ø NEXT R
85Ø GOTO 95Ø
86Ø PRINT"{SHFT CLR}{CRSR DN}"
87Ø PRINTTAB(12)"{CTRL 3}ABCDEFGHIJKLMNO{CTRL 7}"
88Ø FOR R=1 TO 15
89Ø PRINT"{CTRL 3}":PRINTTAB(8)R;TAB(12)"{CTRL 7}";
9ØØ FOR C1=1 TO 15
91Ø PRINT PUZ$(R,C1);
92Ø NEXT C1
93Ø NEXT R
94Ø RETURN
95Ø GOSUB 86Ø
96Ø PRINT"{CRSR DN}"
97Ø PRINTTAB(8)"ENTER COLUMN (A-O):"
98Ø FI=TI
99Ø GET A$:IF A$="" GOTO 99Ø
1ØØØ A=ASC(A$)
1Ø1Ø IF A<65 OR A>79 GOTO 99Ø
1Ø2Ø A=A-64
1Ø3Ø SI=TI
1Ø4Ø PRINTTAB(8)"";
1Ø5Ø INPUT"ENTER ROW (1-15)";RT$
1Ø6Ø RT=VAL(RT$)
1Ø7Ø IF R2=RT AND A=C2 GOTO 119Ø
1Ø8Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
1Ø9Ø PRINTTAB(8)"WRONG.{2 SPACEs}WORD IS IN"
11ØØ PRINTTAB(8)"COLUMN ";CHR$(C2+64);" ROW ";R2"
111Ø FOR N=1 TO 2ØØØ
112Ø NEXT N
113Ø GOSUB 86Ø
114Ø PRINT"{CRSR DN}"
115Ø PRINTTAB(12)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL Ø}{C
     TRL 7}"
116Ø GET A$:IF A$="" GOTO 116Ø
117Ø PRINT"{SHFT CLR}"
118Ø GOTO 25Ø
119Ø PRINT"{SHFT CLR}{2 CRSR DNs}"
12ØØ DF=SI-FI
121Ø ES=INT(DF/6Ø)
122Ø MIN=INT(ES/6Ø)
123Ø SEC=ES-MIN*6Ø
124Ø IF DF<REC THEN FLAG=1:REC=DF
125Ø PRINTTAB(8)"THAT IS CORRECT."
126Ø PRINTTAB(8)"YOU TOOK JUST"
127Ø PRINTTAB(8)MIN;"MINUTES AND"
128Ø PRINTTAB(8)SEC;"SECONDS !!{3 CRSR DNs}"
129Ø IF FLAG<>1 GOTO 131Ø
13ØØ PRINTTAB(8)"NEW RECORD !!!{2 CRSR DNs}"
131Ø FLAG=Ø
132Ø PRINTTAB(12)"{CTRL 9}{CTRL 3}HIT ANY KEY{CTRL 7}"
133Ø GET A$:IF A$="" GOTO 133Ø
134Ø PRINT"{SHFT CLR}"
135Ø GOTO 25Ø
```


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(from p. 10)

8032, and find it about five times faster than an 8250 (thus 20 times faster than a 1541), but a bit harder to use than a Commodore drive. For more information about it, contact its makers, CGRS Microtech, Box 102, Langhorne, PA 19047, 215-757-0284.

Q: What is the function of a light pen? Can it be used for copying program statements from a book or magazine?

M.K. Shadi
Odessa, TX

A: A light pen is a way of allowing the computer to recognize which location on a raster scan video screen (i.e., a TV) is being pointed to. At its simplest, it is used to select items from a menu of choices on the screen. Better versions allow the computer to actually trace patterns drawn by the user on the screen. The best ones, such as Flexidraw (mentioned above), are precise enough to draw detailed pictures. However, none of them read program statements from paper. To do that, you'd need optical character recognition equipment, which is still prohibitively expensive.

Q: What is your opinion of the Radio Shack portable word processor? Do you think Commodore will ever come out with portables run on batteries?

Bob Mueller
Minneapolis, MN

A: I'm using it to reply to your question as I ride in our car. Without our Tandy 100, we'd never get our work done. I like it even better than my 64, but it makes a dandy remote keyboard for the 64. When I finish my writing, I use Telstar 64 from Eastern House Software to copy my work into a disk file that my regular word processor (Paper Clip) can read.

Of course, Commodore will eventually come out with a portable battery-operated computer. That is one of the major trends of the industry, and Commodore is an industry leader, no?

Q: I am the proud owner of a 5K VIC, but I am extremely weary of Out Of Memory errors. I have two choices—upgrade my RAM or go up to a 64. I don't own a business and don't intend to do extensive word processing. I could expand my VIC to 32K for $130. My question boils down to this: Are the features of the 64 that much better than the expanded VIC?

Donald Mead
Grand Blanc, MI

A: You face the same choice I faced in 1979—add 24K of memory to my 8K PET or get the new 32K model. Surprisingly, both options cost the same, so I bought the 32K model. I've never regretted either that decision or a more recent one—not to expand my VIC, but add a 64 instead. 27K of memory at $130 isn't much of a bargain compared to 64K for $200 (with a free computer thrown in). From now on, nearly all the new commercial programs and accessories will be primarily for the 64.

On the other hand, you may soon be able to pick up some very good cartridges and accessories for your 5K VIC at bargain-basement prices. At the right price, you might be perfectly happy just adding 8K to your VIC. Ultimately, the choice (and the responsibility to live with it) is yours, not mine.

Q: Can the VIC be used with the 1702 monitor on the rear connections by buying a 5-pin DIN cable with four RCA plugs? Also, are they available with two RCA plugs to connect the VIC to the front connectors on the 1702?

G.R. Patterson
National City, CA

A: The VIC doesn't separate chrominance and luminance on its monitor connector. Instead, it offers only video out, along with audio out. It can be used with the 1702 by connecting it via the front jacks.

A suitable 5-pin DIN to quad RCA phono connector cable is available from Warren Radio, 800 SW Jefferson, Peoria, IL. Just ignore the extra RCA connectors (or tape them up with electric tape to avoid shorts), but be sure to plug in the correct ones.

Q: I have a VIC and datassette that will not read tapes. How do I determine if the problem is in the recorder or the computer?

Lawrence Joy
Fort Wayne, IN

A: By substitution. Find another VIC and datassette that work properly and substitute your VIC or datassette into that system. If it works there, it's not at fault. Be sure, however, that you first know the commands and connections—get help from your dealer or a skilled user if you need it.

This same technique, substituting parts that might be faulty with parts that you know are good, is used by repair services on all kinds of hardware. Think of it as a logic puzzle—if this is good, then that can't be, and so on.

Q: I have heard that computers and video games, when connected to a TV, interfere with the set. Is this true? Would it be different on the more expensive TVs that have video ports?

Kelvin Pool
Batesville, AR

A: The problem is due to keeping the same picture on the screen for hours on end, as when you leave the computer or game on overnight. The continuous pattern literally burns through the phosphor on the face of your TV tube, leaving a permanent mark.

To avoid this, nearly all computers and video games now go automatically into an Attract mode when you ignore them for more than a few minutes. This is intended not only to interest others in the game, but also to vary the colors and patterns on the screen enough to avoid damaging the TV. The only way a special TV might help alleviate this problem would be if it had an extra-durable coating of phosphor; unfortunately, having or not having a video switch says nothing about the durability of the phosphors used in a given set.

Q: Can I use India ink to reink the cartridge on the MPS 801 ribbon?

Larry Doyle
San Pablo, CA

A: Bad idea! Dot-matrix printers use a special ink, formulated so it won't clog the tiny passages of the printhead, yet will still give it needed lubrication. One product that supplies this, along with a machine that automatically does the reinking, is MacInker, from Com-

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puter Friends, Portland, OR. We have used it at Lincoln College with great success for the past year.

Q: Where can I get a Commodore printer that will work on the VIC?

Rick Ciolli
Boardman, OH

A: Either the 1525 or the former 1515 will work fine. The 1525 is available at nearly all dealers and mass merchants. Unfortunately, the new 801 and 1526 printers do not appear to work on the VIC. Since they have replaced the 1525, it might be wise to buy promptly while the 1525 is still available.

Q: What must be changed to convert North Star Basic so it will run on my 64?

Lloyd Boothroyd
Denver, CO

A: The two most obvious changes are that "!" becomes "REM" to indicate the start of a remark, and "SLASH" becomes ":" to separate multiple statements on the same program line. Most other changes can be looked up in David Lien's excellent book, *The BASIC Handbook*, available from Wayne Green Books (Elm St., Peterborough, NH 03458).

Q: According to *Personal Computing*, Commodore says the save and replace function on the 1541 doesn't work. I have been using a 1541 for about six months and have had no problems using this function. Can you clear up this apparent conflict?

Steve Seale
Florence, AL

A: Five years ago, on the first PET 2040 disk drives with DOS 1, save with replace didn't work properly. It subtly corrupted disk files other than the one in use, usually after the user had scratched improperly-closed files instead of getting rid of them with the disk Validate command. DOS 2 corrected that, and save with replace has worked on all Commodore products since, so far as I know. Old rumors die hard.

Before using save with replace, be sure your disk has enough remaining space to hold a spare copy of your program, since that is part of its way of working. Your current copy is not replaced until the new copy has been successfully saved, ensuring no loss of data in case of a disaster midway through the save.

Companies likely to be around for a while will have some reasonable update policy.

To use save with replace, simply precede your Open or Save command with the sign for at (@), i.e., OPEN 1,8,2,"@0:filename,s,w" and SAVE "@0:filename",8

Programming

Q: Could you please explain why the C-64 clears the screen when reading from or writing to cassette? Is there any way of preventing this? Does it also happen on a monitor?

Bob Wrobel
Morris, IL

A: Yes, no and yes. The 64 turns off (not clears) its screen when using the cassette to avoid interference in cassette operations by the VIC-II video chip. The video chip grabs control of the computer at unpredictable intervals to service its own needs. The delay this adds to the regular processor's operations would disrupt the timing routines used by the cassette if the VIC chip weren't first disabled.

If Commodore had gone to the trouble of finding a better solution to this timing problem two years ago, the 1541 disk and the 1525e and the revised 1526 printers probably wouldn't have been needed, and Commodore could have maintained more compatibility across its entire model line.

Q: Is there any way to transfer my existing programs on tape for the C-64 onto a 1541 disk, and if so, how?

W.J. Gannon
Suffern, NY

A: If the programs are in Basic, simply load them into the computer from the datassette, then resave them to disk. If they're in machine language and have to be loaded with ",1,1" to avoid relocation in memory, you'll need a machine-language monitor (available from user groups) to save them properly. You'll also need to know where they are stored in memory when loaded before the monitor can save them to disk.

Copy-protected programs are another story—some companies have taken steps to prevent you from successfully copying their programs. In those cases, contact the company, tell them you've bought a disk and ask what (if any) trade-in policy they have for changing from a tape to a disk version of their program. Companies likely to be around for a while will have some reasonable update policy to handle this situation.

Q: How can I change the cursor to some other character or symbol? After a while, I get tired of seeing the same old thing just blinking away.

Robert Walder
St. Johns, MI

A: Many others asked this question. You could trade in your computer on the new B model, but I don't recommend doing so. Although a choice of cursor characters is among the benefits offered by the B, you'd also give up all your existing machine language programs, very few of which work on the B as yet.

The cursor on Commodore computers is not precisely a character at all. It is, rather, a frequent shifting of the current print position on the screen from regular to reverse field and back again. The cursor update routine is part of the kernal ROM, and can't be easily changed except within machine language programs that substitute their own input routines for the one in ROM. Either way, you pay a heavy price to avert boredom. R

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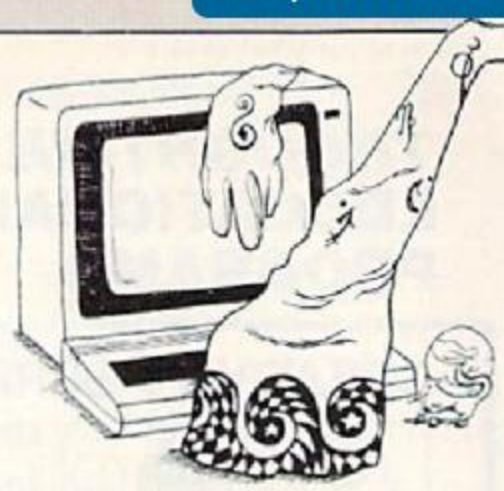
(from p. 14)

Magic



You can use any line or column numbers to print where you'd like or to go back up on the screen and print in data. It doesn't seem to work without the Print statement between the two Pokes.

Unsigned
Parsippany, NJ

$9D C-64 cursor speed—POKE 56325,SP will speed up or slow down the cursor, if SP is any number from 0–255. The lower the number, the faster the cursor moves. The normal value is 58.

Don Saito, Jr.
Torrance, CA

$9E VIC cursor and list speeds—Poking 25 into location 37879 drastically increases the speed at which the VIC's cursor moves around the screen. Poking a value lower than about 20 speeds it up incredibly. Poking a zero causes the screen to scroll slowly while listing a program; the shift-lock key slows it even further and the CTRL key stops the listing for as long as you press it.

Matt Cisternino
Ontario, CA

$9F Appending programs—Here's a way to append one Basic program onto the end of another. It's a Direct mode technique, but you could make a program of it if you'd like. Load your first program, then enter:

```
PRINT PEEK(43)PEEK(44)PEEK(45)
```

Write down the first two numbers that the computer returns. If the third number is 2 or more, then enter:

```
POKE43,PEEK(45)-2:POKE44,PEEK(46)
```

If the third number is 0 or 1, then enter:

```
POKE43,PEEK(45)+254:POKE44,PEEK(46)-1
```

Next, load the program you want to append. It *must* have line numbers higher than those in the first program. Finally, enter:

```
POKE43,x:POKE44,y
```

where x and y are the first and second numbers you wrote down above. List the program, and you'll find that the second program has been attached to the first. You can repeat this whole process to append even more programs to the first two.

Frank Tymon
Lancaster, CA

$A0 Simple sort—If you ever have to put a list of numbers into numerical order, you can have your computer do it without even entering a program.

As long as the numbers are integers between 0 and 63999, just type the number, then type any letter or punctuation mark and press the return key. After all the numbers have been entered in this manner, type LIST, and you'll see that all the numbers are in order.

It's easy to see that the computer interprets those numbers as line numbers; of course, each number will only appear once in the computerized list, no matter how many times it occurred originally. And if your original list is of numbers *plus* other information, you can enter the other information after you type the number, instead of just pressing a key for a letter or punctuation mark. For example, enter:

```
5 GOLDEN RINGS
1 PARTRIDGE IN A PEAR TREE
3 FRENCH HENS
2 TURTLEDOVES
4 CALLING BIRDS
```

It won't list in the classic sequence, but it *will* make order out of chaos.

Richard Bell
Atwater, CA

$A1 Disk protection—Do you want to *permanently* write-protect a 1540/1541 (or 4040) disk? With the following method, the disk will be fully readable, but absolutely cannot be written to by any 1540/41 or 4040 drive.

Byte 02 (i.e., the third byte) of Track 18, Sector 0 normally contains hex $41 (ASCII "A") signifying 4040 format. If this byte is changed to $01, any attempt to write to the disk will fail, with error 73 DOS MISMATCH. (The $01 apparently codes for 2040 format, which is read- but not write-compatible with 4040 format.)

The following short program will do the deed, but *beware*...the only recovery is reformatting the disk. (Of course, the information on the disk can be copied to another, unprotected disk, if the need should arise.)

```
10 REM - OPEN COMMAND CHANNEL AND A DIRECT ACCESS
   BUFFER (DRIVE# 8 ASSUMED):
20 OPEN 15,8,15,"I":OPEN 8,8,8,"#"
30 PRINT#15,"UA:8,0,18,0":REM - READ T18,S0 INTO BUFFER
40 PRINT#15,"B-P:8,2"REM - SET THE BUFFER POINTER TO
   DESIRED BYTE
50 PRINT#8,CHR$(1);:REM - CHANGE THE BYTE TO $01
   (CAREFUL - NO CARRIAGE RETURN)
60 PRINT#15,"UB:8,0,18,0":REM - REWRITE THE BUFFER TO
   THE DISK
70 PRINT#15,"I":CLOSE8:CLOSE15:END:REM - REINITIALIZE,
   DONE!
```

William M. Bennett
Atkinson, NH

$A2 Cassette handling tip—When using a cassette drive with a digital tape counter, save your programs on a series of numbers, such as 10,50,100,150,200 and so on. If you ever lose your card of programs, all you'll have to do is load at these popular numbers to tell what programs are on the tape.

Brian R. Barnholtz
Winona, MN

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$A3 User-friendly program names—I had written a machine language program for my wife, who is not a computer user. I wanted the loading of the program from tape and the running of the program to be as easy as possible.

The solution was to put the program at the beginning of a tape (of course) and to name it with the "SYSxxxxx" command preceded by one CRSR DN, followed by three CRSR UPs. This way, all you have to do is type in LOAD. Then, after the program is loaded, pressing the return key will start the execution.

For example, working from a machine-language monitor, if I were to save a program from $C000 to $C14A, I would issue this Save command in the monitor:

```
.S "{CRSR DN}SYS49152{3 CRSR UPs}",01,C000,C14A
```

If you're working with a disk, this technique obviously gets fairly complicated, since the Load command would have to include the full name with the cursor commands. But for tape, it works well.

Steven Kinsel
Pittsburgh, PA

$A4 Basic/machine language cassette Saves—Basic programs often incorporate short machine language subroutines that are saved in the cassette buffer. This usually requires a routine in the Basic program to Poke the machine language subroutine into the buffer. A simple trick lets you save memory by omitting the Poke routine and saving the entire program together on tape (machine language subroutine and Basic). To use it, just put your machine language somewhere in the range 849–1019 decimal, then execute the following Direct mode line:

```
A$="" : FOR N=849 TO 1019 : A$ = A$+CHR$(PEEK(N)): NEXT
```

When you get the Ready prompt, execute

```
SAVE "program name      "+A$
```

There must be exactly 16 letters and spaces between the quotes, or the subroutine will not load properly. Also note that the starting address of the subroutine *cannot* be the customary 828 decimal, but must be 21 bytes above it.

Alan P. Davenport
Salem, OR

$A5 Joysticks—In most programs that require joysticks, there are times when the player is asked to press a key to continue. If you're writing such a program, why not use the joystick's fire button instead of a key? The following lines will cause a halt in program execution until the appropriate fire button is pressed.

```
WAIT 37137,32,32      VIC-20 joystick
WAIT 145,16,16        C-64 joystick #1
WAIT 56464,16,16      C-64 joystick #2
```

These routines use very little memory compared to other similar ones, which can be very important in the unexpanded VIC, or if your program uses a lot of memory.

E.L. Hayno
Pensacola, FL

$A6 Code conversion—Have you ever wanted to convert a character's Commodore ASCII representation to its screen Poke code? The following function will do it perfectly for every character.

```
DEF FNF(A)=A-161-33*(A<255)-64*(A<192)-32*(A<160)+
32*(A<96)-64*(A<64)
```

The function, usable on both the VIC and C-64, will convert any ASCII value A to its proper code, ready for Poking to the screen. What good is such a function? Well, consider that some word processors store text on disk in ASCII while others use screen codes. It's a good way to convert between the two! Other uses will be found in educational software, graphics programs and general utilities.

For PET/CBM machines, the function is much simpler, and is presented here for owners of those computers.

```
DEF FNF(A)=((A AND 128)/2) OR (A AND 63)
```

It fails to convert CHR$(255) properly, but works for all the rest.

Thomas Henry
Mankato, MN

$A7 Reverse code conversion—The following line of code will convert any Commodore screen code value to the corresponding Commodore ASCII code.

```
A=A+128*(A>127):A=A-64*(A<32ORA>95)-32*(A>63
ANDA<96)
```

Input any screen code value between 0 and 255. Output equals the ASCII value (32 to 127 or 160 to 191).

Edward Guancial
Columbus, OH

$A8 Millionaire's one-liner—In Canada and the northern United States, there's a craze for a lottery called 6/49. Approximately four months ago, the grand prize was $14,000,000. Many groups were formed to buy as many combinations as possible.

The following one-liner prints six random numbers from 1 to 49. You run the program for as many times as you must, to choose groups of six figures. Sometimes, the random choice gives two similar numbers; you just ignore this choice and ask for a new one by typing RUN.

```
10FORX=1TO6:PRINTINT(49*RND(1))+1,:NEXT
```

Jean-Pierre Thivierge
St. Bruno, Quebec

$A9 Word trick—Can you (or your computer) rearrange the letters in ROAST MULES to form one fairly common English word? Maybe a program could print all the permutations of these ten letters, and you could pick that one word out of the 1814400 possibilities. Or are other methods more efficient?

To tell the truth, performing this little exercise is something that most children can do with ease, but it tends to give adults a headache. No magic is involved, and head over heels pursuit of your goal leads directly to success. So turn off your computer, step into the sunny, thought-enhancing fresh air and give it a whirl. We aren't going to *give* you the answer; doing the exercise yourself will be *most* exhilarating. R

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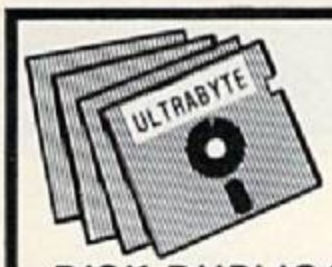

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The Mail RUN

The Hidden Switches

I hope this letter will save Omar Barriga of Columbus, OH (*RUN*, May 1984, Commodore Clinic) and many others the dollars I have spent and the frustration I have experienced with interfaces between the Commodore 64 and my Epson MC80III printer.

I was experiencing difficulty with Tymac's The Connector, when I took the interface apart and found two DIP switches on the hidden side! The ads for The Connector claim it has hardware-switching capacity, but the switches are hidden.

I found that if the lower switch (the one nearest the edge) is open and the second closed, the interface is locked in the Transparent mode. To allow for easier switching for other software, I cut a hole (big enough to expose the switches and just across the lights from the external switch) in the front of the case. My interface problems are now solved.

Burton L. Wood
Milwaukee, WI

Powerful VIC-20

After reading RUNning Ruminations in your April issue, I decided to let you know how I use my C-64 in my testing and inspection company to do accounting and report writing. While still in the stage of "getting around to it," I've come across what I think is probably the most unusual application for a VIC-20 yet.

I recently had the opportunity to perform an inspection service for the Westinghouse Electric Corporation's Transportation Division (WTD) at the Atlanta International Airport. WTD maintains the people-mover train system at this airport. While there, I learned that when Westinghouse Electric, one of the world's corporate giants, was looking for a computer system to monitor the power supply and perform other functions on this train system, they did not choose a system costing thousands of dollars but opted for the "lowly" VIC-20.

Jesse Roger Harris
Oxford, AL

C-64 in Business

In response to April's RUNning Ruminations column ("How Interesting Is Your Commodore?"), I would like to tell you a practical use I have found for my C-64.

In my spare time, I operate a small stained glass business from my home. It has always been a problem bidding commission work for two-dimensional glass projects because there are a number of variables that change from project to project.

Some artists charge a flat fee—$55 per finished square foot. I have a real problem with that approach because the wholesale cost of stained glass varies drastically—usually in the range of $3 to $10 per square foot—which results in a very inconsistent profit margin, not to mention the equity factor between one customer and the next. Also, pattern intricacy has a direct relationship to labor and non-glass material costs (solder, foil and so on).

Other artists keep track of the cost of the materials used and record the time spent working on each project. The customer pays for the cost of the materials, plus a flat hourly rate. The problem is giving an accurate bid prior to beginning the work because it may take more or less time than anticipated.

Other pricing techniques have similar problems, so I turned to my computer for help.

I have only owned my Commodore six months, and aside from one Fortran class, which I took in college ten years ago, I have had no programming or computer experience. Using a couple of Basic programming books, I wrote a program that answers the problems of consistent profit-margin, price equity and accurate bid. I use the resultant program in my part-time business at home.

Craig Porter
Salt Lake City, UT

User's Manual Corrections

I received in the mail *The 1541 User's Manual Errata*, a nine-page manual that really filled those gaps left in the original user's manual (*The Commodore 1541 Disk Drive Manual*). I had about 35 problems with the latter and am sure I'm not alone in this respect.

If any of you are having problems with the original manual, request the free *The 1541 User's Manual Errata* from Commodore's Computer Systems Division, 1200 Wilson Drive, West Chester, PA 19380.

Fred Jones
Louisa, KY

Hey, Neighbors!

I realize there are a relatively large number of Commodore computerists outside the United States, yet I seldom see articles from them.

I am extremely interested in seeing how these fellow computerists use their equipment. I am interested, too, in how they use English to program in a French or Italian environment, as well as others.

James Llanos
Ketchikan, AK

Well, all you non-U.S. Commodorists, we'd be happy to consider your submissions. Let's hear from you.

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Clubs

Focus Group

The following is a listing of the user groups comprising the Federation of Commodore User Societies, Inc. (4301 Columbia Pike, #410, Arlington, VA 22204). The federation is an alliance of Commodore computer groups centered in the Washington, DC area.

The purposes of the federation are to establish lines of information exchange between participating groups, to perform community service and to pool efforts on projects.

VIRGINIA

Washington Area C-64 UG (McLean)
Kent Gardens School, 7 PM, 3rd Thurs.
Martin Smith, 703-523-1995 (Days)
7426 Eldorado St.
McLean, VA 22012

Capitol Area Commodore Enthusiasts
P. Henry Library, 1:30 PM, 2nd Sat.
Don Swinney, 703-938-6313
2312 Tangle Vale
Vienna, VA 22180

Franconia Commodore UG
J. Marshall Library, 3rd Tues.
Mark Sowash, 703-971-5021
6209 Rose Hill Drive
Alexandria, VA 22310

PENTAF (Pentagon)
11:30 AM, Rm 5B1057 (Day varies)
Ralph Poole, 703-273-1337
9912 Colony Road
Fairfax, VA 22030

Dale City Commodore UG
Meeting locations vary
Pat Sullivan, 703-590-4998
4303 Hemingway Drive
Dale City, VA 22193

Arlington VICtims (20/64)
Fairlington Community Cen.,
7 PM, 2nd Wed.
Clifton M. Gladney, 703-524-0236
4501 Arlington Blvd.
Arlington, VA 22204

Washington Area C-64 (Burke)
Burke Library, 4th Sat.
Dick Jackson, 703-360-6749
PO Box 93
Mt. Vernon, VA 22121

Fredericksburg Computer Club
Shelkee Associates, 7:30 PM, 2nd Tues.
Steven Northcutt, 703-371-4184
PO Box 1011, College Station
Fredericksburg, VA 22402

MARYLAND

Southern MD Commodore UG
Temple Hills Comm. Cen.,
7:30 PM, 1st Tues.
Tom Helmke, 301-868-6536
6800 Killarney St.
Clinton, MD 20735

The Boyds Connection
Germantown Campus,
Montgomery College
Tom DeReggi, 301-428-3174
21000 Clarksburg Road
Boyds, MD 20841

Jumpers 2064s (Glen Burnie)
Jumpers Mall, 1st Mon.
Walt Marhefka, 301-768-1892
7837 B&A Blvd.
Glen Burnie, MD 21061

VIClique (Linthicum Heights)
M.I.T.A.G.S., 7 PM, Mon. (varies)
Pat Foley, 301-263-8568
105A Conduit St.
Annapolis, MD 21401

Edison Commodore UG
Naval Research Laboratory
Bill Harr, 301-423-7155
4314 Oxford Drive
Suitland, MD 20746

Gaithersburg C-64 UG
G'burg Library, 3rd Thurs.
Russel Jarosinski, 301-428-3328
12937 Pickering Drive
Germantown, MD 20874

Hyattsville C-64 UG
Red Cross Bldg., 7:30 PM, 3rd Mon.
Kay Alston, 301-779-8369
7209 Dartmouth Ave.
College Park, MD 20740

Rockville VIC/C-64 UG
Aspen Hill Library,
7:30 PM, 3rd Thurs.
Tom Pounds, 301-231-7823
5112 Parklawn Terrace #103
Rockville, MD 20852

Montgomery Co. Commodore
Computer Society
Eastern Intermediate School
7:30 PM, 2nd Wed.
David Menaker, 301-770-6778
5536 Randoph Road
Rockville, MD 20852

Hagerstown Users Group
Loyola Fed. S&L
7 PM, 1st & 3rd Fri.
Joseph Rutkowski, 301-797-9728
23 Coventry Lane
Hagerstown, MD 21740

RUN Amok

Item: In the "Land of Silicon and Glitter," by Tom Benford (April 1984), a reference was made on p. 120 to Studio 64, a music software program, attributing it to Kapri Software. EnTech Software in fact produces Studio 64: Kapri is one of EnTech's distributors.

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Book Gallery

Compiled by Shawn Laflamme

Commodore 64: An Intelligent And Intelligible Guide for the Inquisitive Adult

John A. Heil and Jack Martin
Banbury Books, Inc.
353 W. Lancaster Ave.
Wayne, PA 19087
Softcover, 203 pp., $14.95

Finally, here's a book aimed at the adult newcomers to the world of C-64 computing! It is a very gentle introduction to the basics of Commodore 64 programming, intentionally ignoring all of the finer points. It is for those who bought the C-64 for its entertainment value, or for the kids, but would now like to know what the programming craze is all about.

For a volume that does not profess to cover anything but the basics of Basic, it does an admirable job of covering a lot of territory. While graphics and sound are ignored, you will quickly find yourself into multi-dimensional string arrays, and before you know it, you'll be bubble-sorting with the best of them.

There's something very admirable about authors who can spend 40 pages on just numbers, strings and variables without boring the reader. The pace of this book never seems to drag. The style is very refreshing—it assumes that you can know nothing about computers and still be an intelligent adult, able to read beyond a sixth-grade level.

Far from presenting the Commodore as an omnipotent machine, the authors seem to take pleasure in pointing out a few of its idiosyncrasies. It would be nice to see Heil and Martin cover the more arcane aspects of Commodore programming in a future volume.

The only fundamental technique they ignore in this book is the saving and loading of programs to disk or tape; the only feature missing from the book is a table of contents.

The *Intelligent and Intelligible Guide* is just that, and a must for the adult beginner.

Sharon Aker
Sussex, NJ

Commodore 64 Exposed

Bruce Bayley
Melbourne House Software, Inc.
347 Reedwood Drive
Nashville, TN 37217
Softcover, 198 pp., $14.95

If you are already familiar with computer programming and want to dig deeper, then you might want to try this book. However, if you're a beginner, stay away from this book—it may scare you away from programming.

Commodore 64 Exposed is an excellent book, but it is not for the faint of heart. What some books take a full volume to cover is explained here in only a few pages. The terminology is guaranteed to throw a novice into confusion, and it may even cause problems for a somewhat experienced Basic programmer. For instance, GOTO, If/Then and For/Next are grouped under the heading "Control Structures;" characters, variables and arrays are "Data Structures." Not that I'm arguing with the classifications—actually, I think the entire structure of the book is rather elegant, in the same way that a piece of programming can be elegant when it does the most with the least amount of instructions. Of course, the more elegant the program, or the book, the harder it is for the uninitiated to understand.

The pace of this book is anything but slow—bit masks are introduced by page 16, waveforms are covered in just under a page, and the binary number system is explained in a paragraph. In every case, concepts are explained adequately for readers who have at lease some prior background knowledge.

I can't think of anything that's been left out of this book—it covers Basic and machine code programming, and everything in between.

I can't think of anything that's been left out of this book—it covers Basic and machine code programming, and everything in between. It seems to condense several Commodore programming books into one volume. You can imagine, then, the conciseness and precision that characterizes each section of the book.

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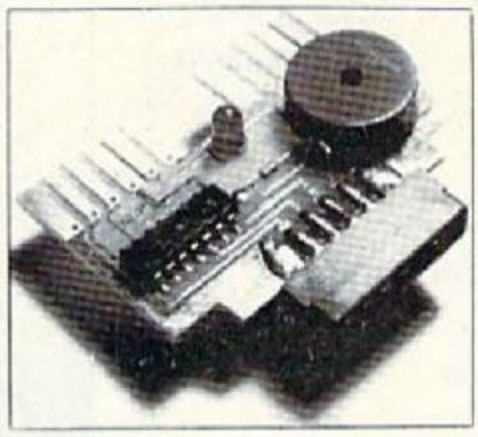

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Commodore 64 Exposed is a wonderful book, if you're a hacker at heart.

Sharon Aker
Sussex, NJ

The VIC-20 Connection

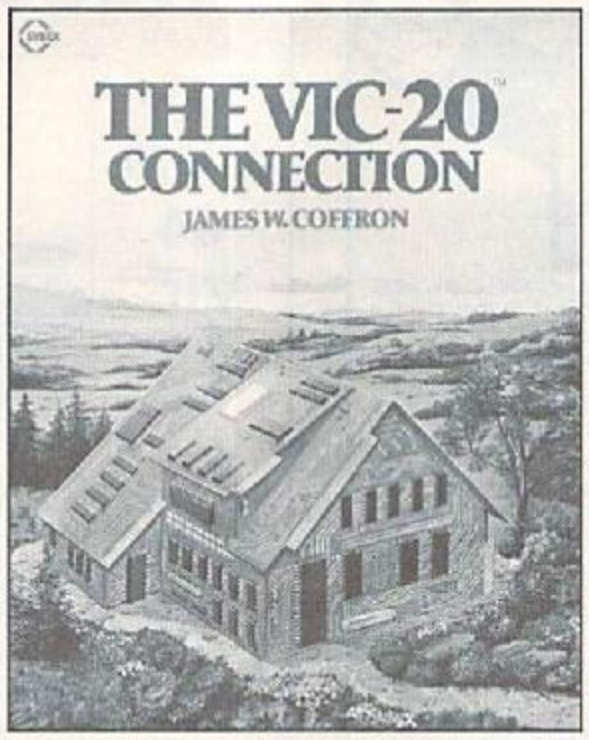
James W. Coffron
Sybex, Inc.
2344 Sixth St.
Berkeley, CA 94710
Softcover, 273 pp., $7.95

The VIC-20 Connection is designed to show you how to interface your VIC with other devices. Being a hardware hack, I was very anxious to delve into this book, but you need not be an electronics expert to benefit from it. According to the introduction: "...an extensive knowledge of Basic is not required to get the maximum value from this text. The hardware concepts are presented with the understanding that many readers may not be familiar with digital electronics."

Author James Coffron's style is easy to read, and, with one exception, the flow of the text is quite logical. In the course of nine chapters there are four practical applications discussed in detail. They are a home security system, a speech synthesizer, an analog-to-digital converter and a digital-to-analog converter.

Chapter one is an introduction to the concepts and vocabulary involved in communicating and controlling external devices with microcomputers. It will get you off to a good start with the general concepts of input and output with your VIC-20.

Chapter two develops programming concepts for outputting data from the VIC-20, while chapter three covers the same skills for inputting data. The techniques of bit-level programming and of inputting or outputting one byte of information are covered. A commercially available training device is used in all examples. Upon investigating, I found that this device costs about as much as a VIC-20 ($89.95 assembled and tested). What makes this even more odd is the subject of the following chapter—it describes some simple electronic circuits (constructable for around $25) that will perform the same functions as the training device used in chapters two and



three. This seems to be the only flaw in the organization of the text material.

An application of computer interfacing is given in chapter five in the form of a home security system. Both the electronic circuitry and programming necessary for implementation are discussed. The security system is a monitor for simple door and window switches; it displays the status of switches on your video monitor. It is presented merely as a stimulus to further investigation and as a means of showing you one of the directions that you can take; it is not a system of any serious value.

Chapter six may well be worth the cost of the book. It describes a phoneme-based speech synthesizer for the VIC-20. (A phoneme is a unit of sound used to construct a language.) The synthesizer is a standard design built with the Votrax SC-01 integrated circuit. The text covers the hardware and programming of speech, and a related appendix contains a phoneme chart for programming about 1400 words. The Votrax speech chip sells for about $40 in unit quantities, so this project could be constructed for approximately fifty dollars (maybe a little more if you don't have a dual-polarity twelve-volt power supply).

A comparison of analog and digital events, along with a discussion of basic transducer theory is given in chapter seven. They serve as an introduction to the materials presented on analog-to-digital conversions and digital-to-analog conversions in chapters eight and nine, respectively. An analog-to-digital converter is described and implemented, showing the necessary software and hardware details; the chapter concludes with a hardware/software system for measuring temperature with the VIC. Although a digital-to-analog converter is presented in enough detail to construct one (even methods of increasing the converter's current drive capability are discussed), no applications of this circuit are given, except for some hypothetical control situations appearing early in the chapter.

There are five appendices containing data sheets for components used in the example circuits, tips on reading a schematic diagram, a glossary, a vendor list and the Votrax phonetic dictionary. There is also a reasonably complete index.

With the exception of the speech synthesizer, all the circuits presented could be built for about $25 (or less if they are built from a fairly well-stocked junk box on a solderless breadboard of some type).

One of the book's weaknesses is that there are some inconsistencies between the text and the illustrations. On one occasion, the text refers to power supplies of polarity opposite to that shown in the accompanying schematic diagram. It took some careful reading of the spec sheets in Appendix A for me to sort out the correct polarities. A similar problem was another schematic that left out an integrated circuit identification number, although that problem was solved by referring to similar circuits used in earlier chapters. At least one of the control programs had an obvious error.

Coffron does not touch on several subjects that you might expect to see in a book of this nature. Serial interfacing is not discussed, and neither are the VIC-20's built-in parallel user's port, nor parallel interfacing with handshaking signals (required by most printers, plotters, etc.).

If you've already done a lot of interfacing work, and if you have a good knowledge of digital circuits and construction techniques, then this book is probably too elementary for you. On the other hand, if you have no previous experience with simple digital circuits, you probably shouldn't buy this book without having a friend or an associate who can help you over the rough spots. This book seems to be best suited for those with a fair amount of programming experience and a good beginning knowledge of digital circuits.

Thomas Franks
Wadsworth, OH

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Written by a college professor in a friendly and informative style, the Blue Book gives you theory of operation, schematics, program listings, parts list, construction hints and sources of materials for each one of the 30 projects.

If you want to get the most out of your VIC this book is a must. Even if you don't plan to build any of the projects, the Blue Book is a valuable source of information on what can be done with the VIC.

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Treasure Hunting at Home—Your C-64 may hold the key to over $20 million in gold, silver and jewels, *if* you're clever enough to crack the code of Beale's treasure.

Telecommunicate with Your Micro—This survey article examines the commercially available "terminal" software that lets you communicate with fellow computerists across town or across the country.

Program Generators—Learn the secret behind "programs that write other programs." This article reviews program generators, and discusses what they are and how they can be used.

Program of the Month—Sprite Aid adds four new Basic commands to let you easily manipulate C-64 sprites.

Soundstick—Using only your joystick, you can set your C-64 humming and ringing with this program, which takes full advantage of the 64's sound capabilities.

Build a Home for Your Micro—You don't have to be a carpenter to design and build your own computer room.

Battleship War—As commander of a battleship, you must defend the fleet from attacking submarines and enemy planes. Arcade-style game for the C-64.

Slide—Match wits against the computer by trying to get five of your tokens in a row either vertically, horizontally or diagonally.

Passage to Zxylon—This game for the unexpanded VIC-20 tests your ability to survive on this "planet of the lost."

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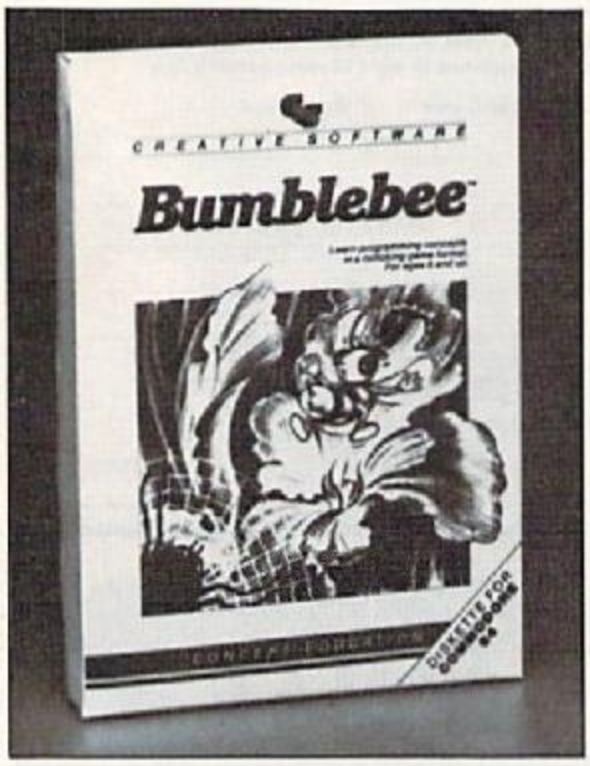

Bumblebee

Bumblebee introduces computer programming concepts in a game format. It is designed for children aged six and up.

The player controls Bartholomew the bee, giving him instructions that enable him to move from flower to flower and collect pollen points. His flight pattern must be carefully designed, or he will bump into walls or be caught by Olga, the evil garden spider. If Bart returns safely to the beehive, the screen lights up with a graphics display.

Bumblebee features various levels of difficulty, requiring the construction of increasingly complicated flight patterns.

Bumblebee is available on cartridge for the Commodore 64. It retails for $34.95. Creative Software, 230 East Caribbean Drive, Sunnyvale, CA 94089.

Check Reader Service number 410.

Disk Utility Programs

Softron, Inc. (150 Nassau St., Suite 2024, New York, NY 10038) has released two disk utility programs for Commodore owners.

Ez/Disk is designed to eliminate lengthy Basic commands. You can call up the menu anytime, and your program in memory remains intact until you load or run another program. Ez/Disk supports up to four disk drives. It is available on disk for the C-64 and the VIC-20. It retails for $24.95.

Ez/Disk Plus gives you the functions of Ez/Disk, plus the ability to copy disks with one or two drives, print files directly from disk to the screen or printer, append Basic programs to a memory-resident program and more. It is available on disk for the C-64. It retails for $34.95.

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Low-Priced Word Processor

Educomp (2139 Newcastle Ave., Cardiff, CA 92007) has released Quickwriter II, a word processing program for the Commodore 64.

The program has over 60 commands including transfer, insert, delete, append and clip-and-save words, sentences or paragraphs. You can search for words and phrases, hyphenate, justify, set tabs and create form letters.

Quickwriter II's printer routine is compatible with most combinations of printers and interfaces. It allows you to use printer features such as italics, bold and underline.

Quickwriter II is available on disk and cassette for $19.95.

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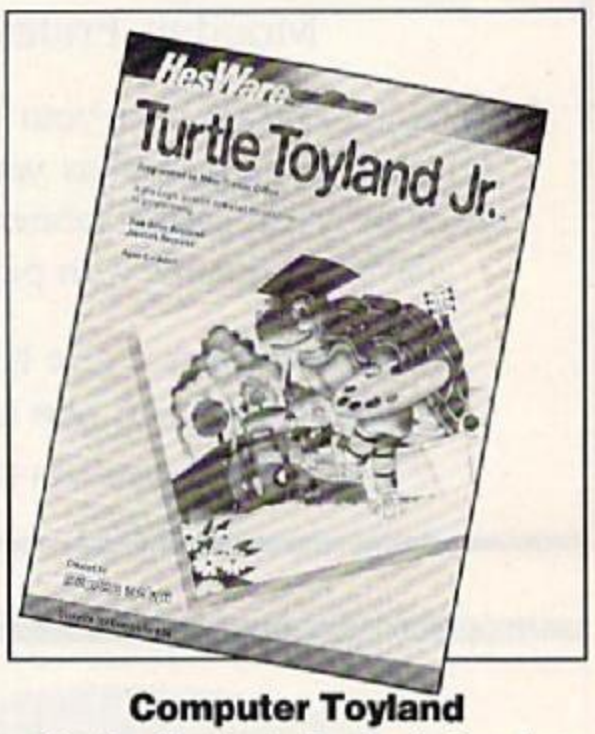

Computer Toyland

Turtle Toyland Jr. is designed to teach computer concepts to children aged six and up. Using a joystick, the child moves a turtle across the screen to build film strips.

The sequence of activities begins with a playground where children learn how to move the turtle and draw images. After a stop in Training Land, children can try four other activities: Music Land, Sprite Land, the Toybox and Input/Output Land.

In Music Land, children learn to write their own music, using the joystick to control notes from a piano, horn, guitar and flute. In Sprite Land, children use the joystick to draw sprites. Music and sprites can be stored in the Toybox. In Input/Output Land, files saved in the Toybox can be called up and played with again.

Turtle Toyland Jr. is available on disk and cassette for the Commodore 64. It retails for $34.95. Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005.

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Enter the Olympics!

Epyx, Inc. (1043 Kiel Court, Sunnyvale, CA 94089) has released Summer Games, featuring athletic events of the Summer Olympics.

Events include swimming, 100-meter dash, 400-meter relay, diving, pole vaulting, skeet shooting and the floor vault in gymnastics. Up to eight players can compete in each of the games; players can represent any one of 18 different national teams.

Summer Games opens with the traditional Olympic torch-lighting ceremony. At the end of each event, the gold, silver and bronze medalists climb the pedestal to claim their medals.

Summer Games is available on disk for the Commodore 64.

Check Reader Service number 421.

Freudian Drama

Screenplay (PO Box 3558, Chapel Hill, NC 27514) has released Institute, a psychological drama for C-64 owners.

In Freudian fashion, the clues to your escape from the Institute can only be found through a series of four dreams, induced by a mysterious red powder.

You may find yourself in a prehistoric jungle or aboard the doomed Titanic. Whatever the adventure, you must watch closely, since each one of these dreams provides information that you will need to make your escape.

Institute is available on disk for $29.95.

Check Reader Service number 422.

Add-On RAM Cards

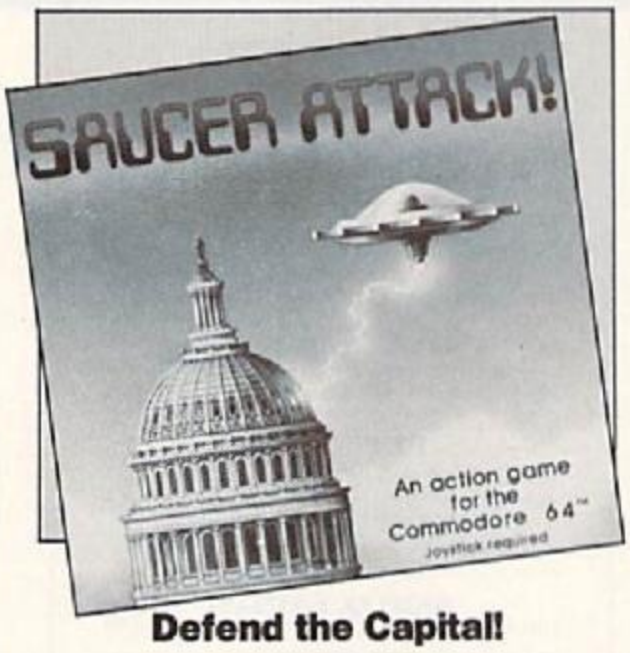
Lindgren Associates (127 Main St., Brattleboro, VT 05301) has introduced a line of add-on RAM cards offering from 64K to 256K of additional on-line memory for the Commodore 64.

The RAM Disc Card can be used for data storage during computation, appending Basic programs from standard disks or any operation requiring access to large amounts of data storage.

The RAM Disc package includes the RAM Disc memory board with battery backup and a two-slot expansion interface that enables autostart cartridges to use the RAM Disc. Two software programs are also included: the first is the boot and operating system for the CP/M module that allows you to select from 24K to 60K for CP/M; the second is a monitor program that allows the manual start-up of cartridge-based programs.

The 64K RAM Disc is available for $370. All 256K of RAM are fully socketed, allowing you to expand to the full 256K capacity. The list price for each additional 64K of RAM is $70.

Check Reader Service number 428.



Defend the Capital!

Sachs Enterprises (PO Box 1182, Lake Arrowhead, CA 92352) has released Saucer Attack! for the Commodore 64.

You must defend Washington, DC against an alien invasion. The pace of the action grows faster as you battle through the day and into the night.

The game features multicolor, bit-mapped graphics and sound effects. It is available on disk or cassette for $29.50.

Check Reader Service number 433.

Manage Your Finances

Sundex Software Corp. (3000 Pearl St., Boulder, CO 80301) has released two new personal financial software packages for the Commodore 64.

Personal Payables is a bill-paying package that handles multiple bank accounts and prints checks with addresses for window envelopes. It is available on disk for $49.95.

Certified Personal Accountant also handles bill-paying and includes net worth, budget, cash flow and tax computations, money market and credit card accounts and a simple stock portfolio. It is available on disk for $99.95.

Check Reader Service number 400.

New Versions of Mirage's Word Processor

Mirage Concepts, Inc. (2519 W. Shaw #106, Fresno, CA 93711) has released personal and professional versions of its word processing program for the Commodore 64.

The Word Processor–Personal is written in 100% machine language, with features including word wrap and block operations. The program can be merged with Mirage's Database Manager to produce continuous form letters. It is available on disk for $39.95.

The Word Processor–Professional is an upgraded version of the program, including a built-in spelling checker, an advanced print section and enhanced printer compatibility. It is available on disk for $89.95.

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Teach Your C-64 to Spell

Batteries Included (186 Queen St. West, Toronto, Ontario, Canada M5V 1Z1) has introduced SpellPack, a spelling checker for the Commodore 64.

SpellPack can check an entire document in two to four minutes. It contains a dictionary of over 20,000 of the most commonly used words in the English language. The program compares each word in your document with its internal dictionary. It highlights words not found, and you can then edit misspelled words.

You can expand the dictionary with over 5000 terms, including the technical vocabulary that you use in your field. SpellPack can be used with the documents created by most major C-64 word processing programs. It is available on disk for about $40.

Check Reader Service number 402.

Educational Software For the C-64

Program Design, Inc. (95 East Putnam Ave., Greenwich, CT 06830) has released new educational software for the Commodore 64.

Analogies is a series of six programs that define and describe the common types of analogies. The programs teach a method for analyzing analogies and provide practice in working with all types of analogies. The final lesson tests the student's abilities.

Vocabulary Builder 1 is a series of 11 programs with vocabulary questions on synonyms and antonyms. The last lesson is a vocabulary test. Two-thousand words are covered, and 400 questions are provided. Vocabulary Builder 2 is another series of 11 programs using a more advanced word list.

The three packages are available on disk for $26.95 each and cassette for $21.95 each.

Check Reader Service number 405.

Undersea Adventure

Infocom, Inc. (55 Wheeler St., Cambridge, MA 02138) has released Seastalker, a text adventure game for the Commodore 64. It is designed for ages nine to adult.

You must save the Aquadome, the world's first undersea research station. Your specially equipped submarine, the Scimitar, is ready. However, you haven't tested the Scimitar in deep water, and if you challenge the briny deep without charting the right course, you might wind up as shark's bait. To add to your troubles, the crew of the Aquadome may have a traitor in its ranks.

The Seastalker portfolio includes the program disk, Submarine Logbook, top secret Infocards with decoder film (used to reveal clues), a nautical chart of Frobton Bay and a Discovery Squad decal. It is available for $39.95.

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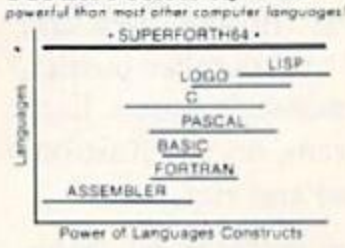

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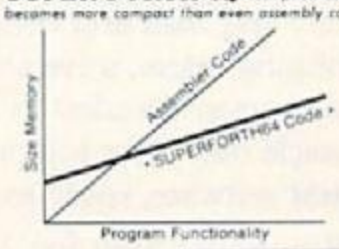

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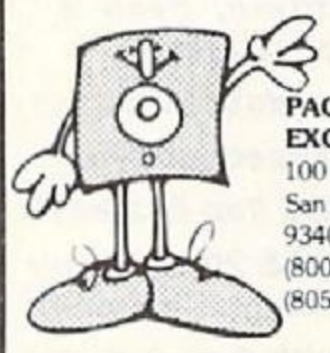

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Lost Tomb is available on disk for the Commodore 64. It retails for $29.95. Datasoft, Inc., 19808 Nordhoff Place, Chatsworth, CA 91311.

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Aid for the Statistician

Stat 64 is designed to simplify the work involved in making graphic displays with statistics.

The program adds 19 commands to Basic. You can create horizontal or vertical bar charts and plot with 3871 points. There are also statistical commands for calculating mean value, standard deviation and variance.

Stat 64 is available on cartridge for the Commodore 64. It retails for $29.95. A VIC-20 version is also available. Handic Software, Inc., Fellowship Business Center, 520 Fellowship Road, B206, Mount Laurel, NJ 08054.

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Become a Corporate Boss

Management Decision tests your ability to develop and operate a new company.

For a period of 18 months, you will be a company president, in a position to guide your company to profit and success—or lose your shirt. The program is designed to help you understand the relationships between production, accounting and marketing, and the strategy and planning necessary to make a profit.

Management Decision is available on disk and cassette for the C-64. It retails for $25. Infinity Software, 536 Curie Drive, San Jose, CA 95123.

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Boulder Dash

In Boulder Dash, you must maneuver Rockford through 16 different caves in a quest for jewels. Each cave is composed of several scrolling screens, where magical, powerful adversaries confront Rockford at every turn.

A world of boulders, earth, giant amoebas, fireflies and secret passages combine in numerous patterns to produce a variety of scenarios. Concentration, strategy, logic and forethought are needed for success.

After completing four consecutive levels, you are rewarded with a puzzle.

Boulder Dash is available on disk for the Commodore 64. MicroLab, 2699 Skokie Valley Road, Highland Park, IL 60035.

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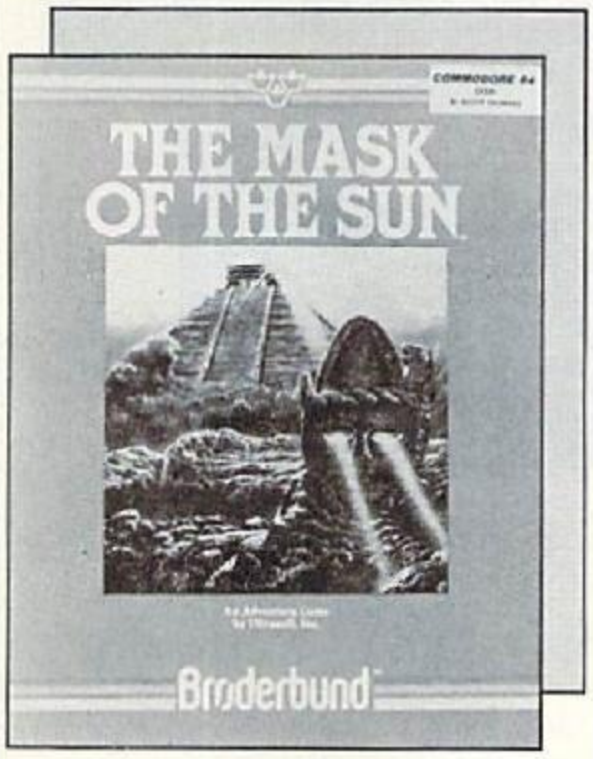

Aztec Adventure

Broderbund Software, Inc. (17 Paul Drive, San Rafael, CA 94903) has released The Mask of the Sun, an adventure game for the Commodore 64.

As an archaeologist, adventurer and treasure hunter, you must search the Aztec ruins of Central Mexico for the Mask of the Sun, a long-lost artifact. It is said that this ancient mask is made of solid gold and gives its wearer invincibility.

You'll encounter peril at every turn as you uncover the secrets of this ancient civilization.

The Mask of the Sun is available on disk for $39.95.

Check Reader Service number 424.

Picture Perfect

K.T. Software (PO Box 4943, Huntsville, AL 35815) has released Picture Perfect, a custom print program for generating gray-level reproductions of any picture drawn with the C-64 and saved on disk with the Koala Pad Micro-Illustrator from Koala Technologies, Inc.

Picture Perfect is 100% machine language, menu-driven and controlled by the function keys. It includes a disk directory, picture display and print edit modes.

Picture Perfect supports the Epson RX-80, FX-80 and Gemini 10X printers. It is available on disk for $30.

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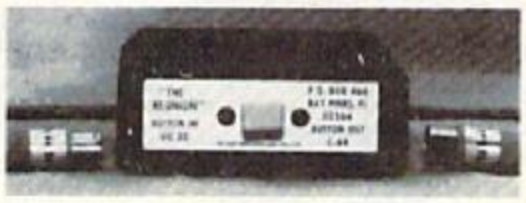

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RS-232 Interface

Omnitronix (PO Box 12309, Seattle, WA 98111) has released the RS-232 Interface for the VIC-20 and the C-64.

The RS-232 Interface plugs into the User I/O port of the computer and converts the Commodore TTL signals to true RS-232. A two-foot cable from the interface ends in a male DB25 connector. The interface allows you to drive almost any serial device, such as a modem or serial printer.

The documentation contains a type-in machine language printer driver, a Basic dumb terminal program and instructions for listing a Basic program to the serial printer.

The RS-232 Interface is available for $39.95.

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Pro Golf

HomeComputer Software, Inc. (1307 S. Mary, Suite 209, Sunnyvale, CA 94087) has released Pro Golf, designed by PGA champion Tom Weiskopf.

The game simulates the 18 toughest holes that pros will encounter during the 1984 PGA tour. Pro Golf's features include: random wind, rain and pin placement; club selection; putting on contoured greens and handicapping.

Options allow you to go to the putting green, play the front or back nine, play all 18 holes, practice a specific hole several times or begin at any hole and play to the end of the course. Weiskopf offers you playing tips for each of the 18 holes. USGA rules can be called up to settle arguments.

Pro Golf is available on disk for the Commodore 64. It retails for $39.95.

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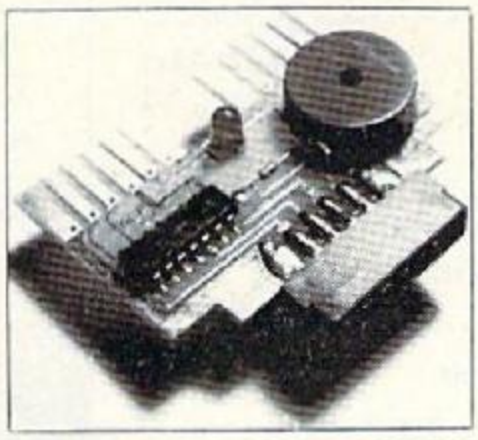

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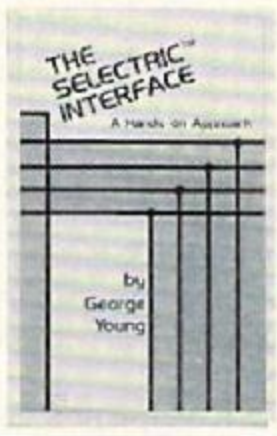

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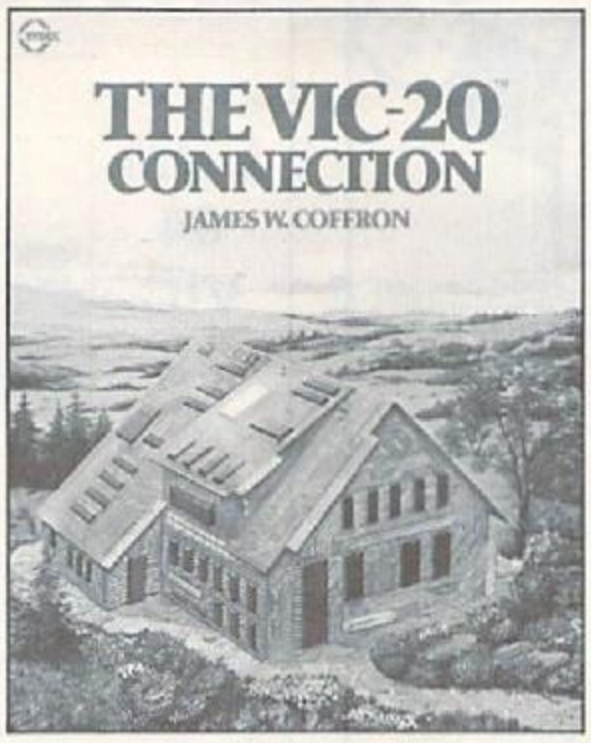
Commodore 64 Exposed is a wonderful book, if you're a hacker at heart.

Sharon Aker
Sussex, NJ

The VIC-20 Connection

James W. Coffron
Sybex, Inc.
2344 Sixth St.
Berkeley, CA 94710
Softcover, 273 pp., $7.95



The VIC-20 Connection is designed to show you how to interface your VIC with other devices. Being a hardware hack, I was very anxious to delve into this book, but you need not be an electronics expert to benefit from it. According to the introduction: "...an extensive knowledge of Basic is not required to get the maximum value from this text. The hardware concepts are presented with the understanding that many readers may not be familiar with digital electronics."

Author James Coffron's style is easy to read, and, with one exception, the flow of the text is quite logical. In the course of nine chapters there are four practical applications discussed in detail. They are a home security system, a speech synthesizer, an analog-to-digital converter and a digital-to-analog converter.

Chapter one is an introduction to the concepts and vocabulary involved in communicating and controlling external devices with microcomputers. It will get you off to a good start with the general concepts of input and output with your VIC-20.

Chapter two develops programming concepts for outputting data from the VIC-20, while chapter three covers the same skills for inputting data. The techniques of bit-level programming and of inputting or outputting one byte of information are covered. A commercially available training device is used in all examples. Upon investigating, I found that this device costs about as much as a VIC-20 ($89.95 assembled and tested). What makes this even more odd is the subject of the following chapter—it describes some simple electronic circuits (constructable for around $25) that will perform the same functions as the training device used in chapters two and three. This seems to be the only flaw in the organization of the text material.

An application of computer interfacing is given in chapter five in the form of a home security system. Both the electronic circuitry and programming necessary for implementation are discussed. The security system is a monitor for simple door and window switches; it displays the status of switches on your video monitor. It is presented merely as a stimulus to further investigation and as a means of showing you one of the directions that you can take; it is not a system of any serious value.

Chapter six may well be worth the cost of the book. It describes a phoneme-based speech synthesizer for the VIC-20. (A phoneme is a unit of sound used to construct a language.) The synthesizer is a standard design built with the Votrax SC-01 integrated circuit. The text covers the hardware and programming of speech, and a related appendix contains a phoneme chart for programming about 1400 words. The Votrax speech chip sells for about $40 in unit quantities, so this project could be constructed for approximately fifty dollars (maybe a little more if you don't have a dual-polarity twelve-volt power supply).

A comparison of analog and digital events, along with a discussion of basic transducer theory is given in chapter seven. They serve as an introduction to the materials presented on analog-to-digital conversions and digital-to-analog conversions in chapters eight and nine, respectively. An analog-to-digital converter is described and implemented, showing the necessary software and hardware details; the chapter concludes with a hardware/software system for measuring temperature with the VIC. Although a digital-to-analog converter is presented in enough detail to construct one (even methods of increasing the converter's current drive capability are discussed), no applications of this circuit are given, except for some hypothetical control situations appearing early in the chapter.

There are five appendices containing data sheets for components used in the example circuits, tips on reading a schematic diagram, a glossary, a vendor list and the Votrax phonetic dictionary. There is also a reasonably complete index.

With the exception of the speech synthesizer, all the circuits presented could be built for about $25 (or less if they are built from a fairly well-stocked junk box on a solderless breadboard of some type).

One of the book's weaknesses is that there are some inconsistencies between the text and the illustrations. On one occasion, the text refers to power supplies of polarity opposite to that shown in the accompanying schematic diagram. It took some careful reading of the spec sheets in Appendix A for me to sort out the correct polarities. A similar problem was another schematic that left out an integrated circuit identification number, although that problem was solved by referring to similar circuits used in earlier chapters. At least one of the control programs had an obvious error.

Coffron does not touch on several subjects that you might expect to see in a book of this nature. Serial interfacing is not discussed, and neither are the VIC-20's built-in parallel user's port, nor parallel interfacing with handshaking signals (required by most printers, plotters, etc.).

If you've already done a lot of interfacing work, and if you have a good knowledge of digital circuits and construction techniques, then this book is probably too elementary for you. On the other hand, if you have no previous experience with simple digital circuits, you probably shouldn't buy this book without having a friend or an associate who can help you over the rough spots. This book seems to be best suited for those with a fair amount of programming experience and a good beginning knowledge of digital circuits.

Thomas Franks
Wadsworth, OH

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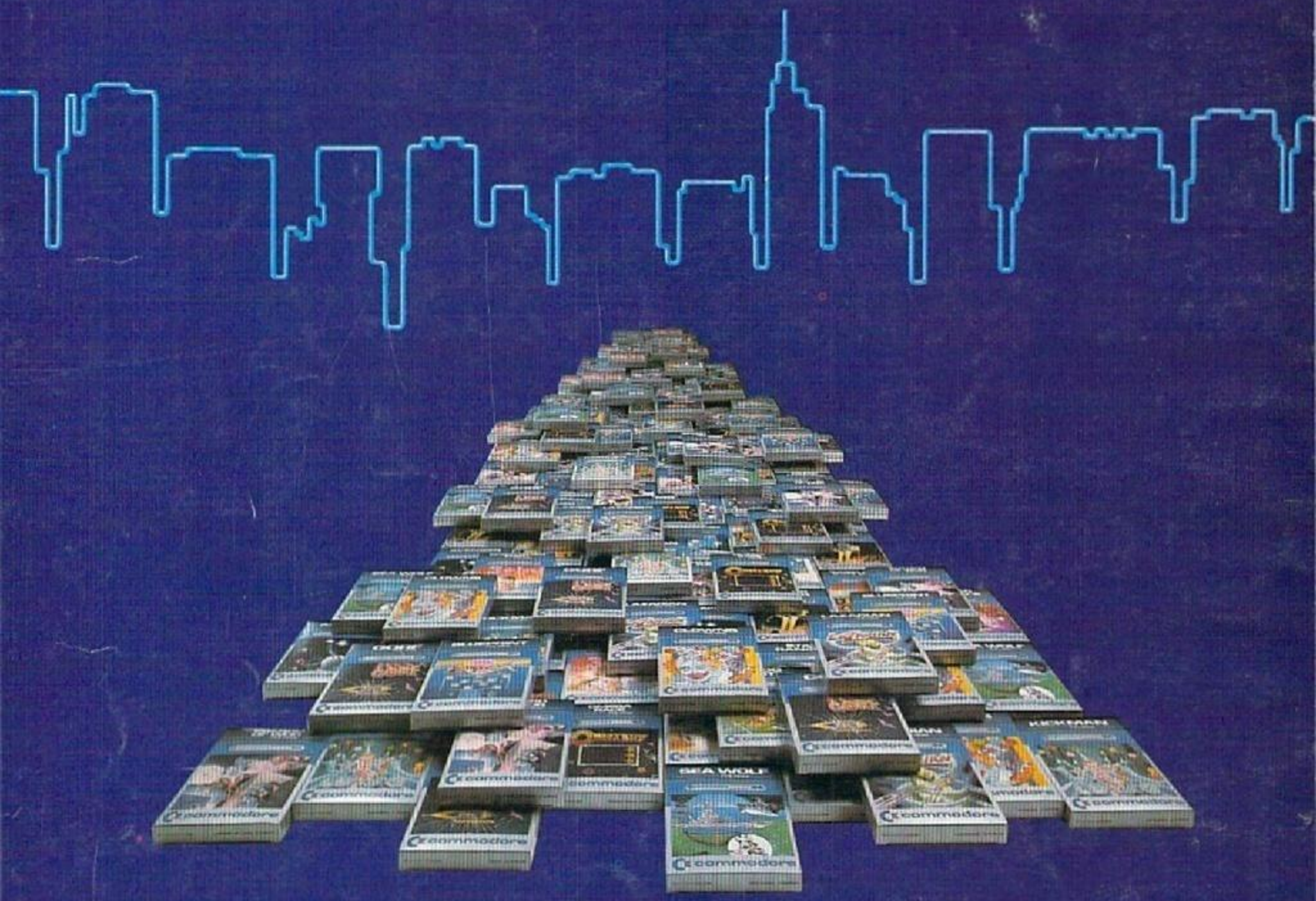

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